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Johannes Harris. D. D
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Lexicon Technicum:

Or, An UNIVERSAL

Engliſh Dictionary

OF

ARTS and SCIENCES:

EXPLAINING

Not only the TERMS of ART, but the ARTS Themſelves.

In TWO VOLUMES.

By *JOHN HARRIS*, D. D. and F. R. S.

The FIFTH EDITION.

Now digeſted into one ALPHABET: With very conſiderable ADDITIONS and IMPROVEMENTS from later Diſcoveries in *Mathematicks* and *Philoſophy*, &c. Illuſtrated with ſeveral Additional COPPER-PLATES, and many new *Diagrams*.

VOL. I.

LONDON:

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TO

His Royal Highneſs.

GREAT SIR,

I *Juſtly eſteem it a Peculiar Happineſs, that* You *were pleas'd to accept of the Patronage of this Work; for hereby you exempt me from that Hardſhip which attends moſt Dedicators, of inventing the Virtues they celebrate.*

But though your intrinſick Excellence and real Worth takes away all Poſſibility of Flattery, yet being convinced that whatever I can ſay, falls ſhort of your Merit, I bluſh as much at my Incapacity of giving you Your juſt Due, as I ſhould at aſcribing more than He deſerved to another.

Your Early Years, GREAT SIR, *ſhew'd your* Skill *and* Conduct *in Arms, as well as the Greatneſs of your Courage and Love for Glory; and 'twas an uncommon Happineſs your* Bravery *was more than once bleſs'd with, by your own Perſonal Valour to Save your* Royal Brother, *Rout the Enemies Troops, and Change the Fate of the Battle.*

After this, when your Happy Alliance with Your Royal Conſort, *Our preſent Gracious and moſt Excellent* QUEEN, *had made You* Ours, *though you were always ready to offer your Self to Command Our Armies or Our Fleets, yet when we deny'd our Selves the Happineſs of your Conquering for us* Abroad, *you ſet your Self to ſhew us an illuſtrious Example of Virtue and Goodneſs at* Home; *and prov'd your Self to be as much above* Pride *and* Revenge here, *as you would have been without* Fear *or* Surprize there.

Great within Your Selves Alone, Your Royal Conſort *and* Your Self, *like the beſt of the Old* Roman *Generals and Conſuls, liv'd Retir'd indeed, but neither unactively nor unuſefully: Virtue and Piety You taught, by the beſt Way of recommending it, Your own Bright, Great, and Glorious Examples; And raiſed up the Conjugal Happineſs to ſuch a Degree of Perfection, as the World never knew before, and which could You have been* Unbeloved, *would have render'd you almoſt the Envy of every one.*

Then, Mighty Sir, *did You employ your Noble Mind in Studies of the greateſt Uſe and Benefit to Mankind here,* Mathematicks *and* Mechanicks; *and as Your Cloſet was always the Reſort of the uſefully Learned and Ingenious, ſo were you ſtill their Encourager and Patron.*

But when the Providence of GOD *called Your Illuſtrious Princeſs to* Empire, *and Your Self to Publick Buſineſs and Mighty Employments, You ſoon* Both *ſhew'd You could Command with as much Wiſdom and Conduct, as you could before Obey with Reſignation, and make our Nation Truly Happy by the Gracious and Excellent Adminiſtration of your Government.*

The Glorious Effects of which that we may long Enjoy, and that Our Gracious Queen, *and* Your Royal Highness, *may be Bleſſed with Iſſue to inherit theſe* Great Dominions, *that I doubt not but* GOD *hath raiſed up* Her Sacred Majesty *to ſecure in laſting Peace and Happineſs to us, is,*

Great Sir,

The moſt Sincere and conſtant Prayer
of Your Royal Highness's
Moſt Obedient and Moſt Humble Servant,

John Harris.

THE

PREFACE.

THE beſt Account I can give of the following Work, will be to lay before you in a ſhort View what it contains, wherein it differs from other Books which may ſeem to be of the ſame Nature, and from whence I have collected the Subſtance of it. That which I have aimed at, is to make it a Dictionary, not only of bare Words, but *Things*; and that the Reader may not only find here an Explication of the *Technical* Words, or the Terms of Art made uſe of in all the *Liberal Sciences*, and ſuch as border nearly upon them, but alſo thoſe *Arts themſelves*; and eſpecially *ſuch*, and *ſuch* Parts of them, as are moſt uſeful and advantageous to Mankind. In this, which was the chief of my Deſign, I found much leſs Help from Dictionaries already publiſhed, than one would have expected from their *Titles*: *Chauvin*'s *Lexicon Rationale*, or *Theſaurus Philoſophicus*, is a well printed Book, and the Figures are finely Graved; but 'tis too much filled with the School Terms, to be uſefully inſtructive, and is as defective in the modern Improvements of Mathematical and Phyſical Learning, as it abounds with a Cant which was once miſtaken for *Science*.

The *Grand Dictionaire Des Arts & Sciences, par Meſſ. de l'Academie Francoiſe*, hath no Cuts nor Figures at all, and is only a bare Explication of Terms of Art; and it ſeems rather to have been deſign'd to improve and propagate the *French Language*, than to inform and inſtruct the human Mind in general. And, which I have often wonder'd at, 'tis filled every where with *Simple Terms*, ſo that you are told what a Dog, a Cat, a Horſe, and a Sheep is; which, tho' it may be uſeful to ſome Perſons who did not know *that* before, and may ſhew very well, that ſuch Deſcriptions can be given in *French*; yet how the bare Names of Animals and Vegetables, of Metals and Minerals, can be reckoned as *Terms of Art*, and conſequently make the greateſt Part of a *Dictionary of Arts and Sciences*, I confeſs I cannot ſee: And therefore, though this and Mr. *Furetier*'s *Dictionary* may be Books very well done in their Way, and are certainly very uſeful for thoſe who would be perfectly acquainted with the *French* Tongue; yet I did not find much Aſſiſtance from them, with regard to my Deſign.

And much leſs Help was there to be had from a Book called, *The New World of Words*, or *an Univerſal* Engliſh *Dictionary*; for there I found the Compiler had the *ill Luck* to collect many *Foreign* Faults, and to underſtand little or nothing of the *Arts* and *Sciences* himſelf.

Mr. *Ozanam*'s *Dictionaire Mathematique*, is indeed as good a Book as *Vitalis*'s is a bad one; and had *Mathematicks* been a Science I was the leaſt acquainted with of any other, I ſhould have been generally as well ſupplied from *Ozanam*, as deceived by *Vitalis*; whoſe laſt Edition, in two Volumes at *Rome*, after ſo many Years Time to conſider upon the Matter, is, I think, not better than the firſt, becauſe it hath more Matter, and leſs to the Purpoſe.

The *Chymical* and *Phyſical Dictionaries* of *Johnſon*, *Caſtellus*, and *Blanchard*, have a great many Words and Terms that are not to be met with elſewhere; and the laſt hath had four Editions in our own Language; but though many things are well enough done in him, yet ſome can hardly be ſaid to be ſo; ſo that in many Places I have been obliged to put his Name to what my *Amanuenſis* or *Aſſiſtant* tranſcribed from him, leſt the Reader ſhould miſtake it for my own Words.

I write not this only to diſparage the Performances of others, or to build my ſelf a Reputation on their Ruins, but I think my ſelf obliged to acquaint the Reader with the plain Truth of Things, without Favour or Affection; that ſo he may be informed where to meet with Satisfaction in his Enquiries and Reading, and where not; and perhaps if this were oftner done, both the Time and the Expence of gaining true Knowledge would be much ſhortned.

There are ſome other leſſer Dictionaries which are of good Uſe, and which have been ſerviceable to me on Occaſion, which I ſhall mention below; but I muſt next acquaint the Reader, That *much the greater Part* of what he will find here is collected from no *Dictionaries*, but from the beſt original Authors I could procure in all Arts and Sciences, and is the Reſult of ſome Years Labour and Conſideration.

I have been very full and particular in the *Mathematicks*, becauſe it is the only ſolid Foundation on which an Uſeful Enquiry into Nature, and all Phyſical Learning, can poſſibly be built; and becauſe 'tis alſo of the greateſt Uſe and Advantage to Mankind in all Reſpects.

In *Geometry*, under the Name of each Figure you have the eſſential Properties of it briefly and plainly demonſtrated, and the Application to the Practice ſhewed; ſo that by the Help of very eaſy

References from one Place to another, you will find the Demonſtration of all ſuch uſeful and important Propoſitions in that noble Science, as are uſually given by *Geometrick* Writers.

Under ſuch Words as *Parabola*, *Ellipſis*, *Hyperbola*, *&c.* in the *Conick Sections*, you will find the Properties of each Figure or *Section* demonſtrated, with Methods for their Deſcription on a Plane; as alſo the Properties of the *Cycloid*, *Conchoid*, *Logarithmick-Line*, *Ciſſoid*, *Quadratrix*, and *Spiral Lines*, *&c.* Some general Conſiderations of the Nature of *Aſymptotes*, the Nature and Properties of *Catacauſtick* and *Diacauſtick* Figures, of the *Involute* and *Evolute*, of the *Linea Celerrimi Deſcenſus*, *&c.* And under the Word *Conſtruction*, you have the Conſtruction of *Cubick* and *Biquadratick Equations* by the *Parabola*; together with the Inveſtigation of *Baker*'s *Central Rule*, and its Uſe and Application.

Under ſuch general Words as *Trigonometry*, *Surveying*, *Spherical Geometry*, *Projection*, *&c.* you will find entire Treatiſes on theſe Heads; and which, if I miſtake not, are as ſhort and plain as any yet extant.

In *Algebra* you will meet, under the proper Heads, every thing that is uſually found in Treatiſes of this Nature, and perhaps ſomething more. And under *Fluxions* you have a ſuccinct Account of the *Nature* and *Algorithm* of them, and ſome Improvements which are not to be had elſewhere. And in ſeveral Places under the proper Words, you have an Account of what we now call the *New Methods*, or *Univerſal Ways of Inveſtigation*; as particularly, a Method of drawing of *Tangents* to all Sorts of *Curves*, a Method *de Maximis & Minimis*, *&c.* of finding the *Centers of Gravity and Oſcillation*; of finding the *Unciæ*, *&c.* All the Parts alſo of *Common Arithmetick* are explained here, and its Application to *Anatociſm*, *Compound Intereſt*, and *Annuities*; together with the Doctrine of Surds, the Method of Extraction of Roots by *Converging Series*, and the entire Doctrine of Promotion; all Kinds of Progreſſion, Fractions, Logarithms and Decimals: And I have alſo, from the beſt Authors I could get, collected an Account of the ancient Weights and Meaſures of all Nations, and adjuſted them with our own; and have given you very large and uſeful Tables of the Values of all modern or preſent Foreign Weights, Meaſures, and Coins, compared with our own. I have inſerted alſo, from Dr. *Wallis*, a large Account of *Sexageſimal Fractions*. You will find here alſo the Deſcriptions and Uſes of both the Celeſtial and Terreſtrial Globe; the Doctrine of the Sphere, according to the New and Old Hypotheſis; together with the Demonſtration and Practice of Spherick Projections *in Plano*; and moſt

of

of the uſeful Things in *Aſtronomy*, as the *Phænomena*, *Parallaxes*, *Magnitudes*, *Motions* and *Diſtances* of the *Planets* and their *Satellites*; and in particular, the Incomparable Sir *Iſaac Newton*'s *Theory of the Moon*, and a very large Account of *Comets* from the ſame Author. You will have alſo the Ground and Practice of *Dialling*; the Nature and Uſe of *Opticks*; the taking all *Heights* and *Diſtances*; the *Menſuration* of *Surfaces*; *Gauging*; the *Art* of *Chronology*, *Geography*, *Coſmography*, *Muſick*, &c.

In *Gunnery* you have the Method of Shooting in Great Guns and Mortars, with Captain *Halley*'s and *Anderſon*'s Tables; and as to *Fortification*, I have conſulted the beſt Books and Drawings; and I believe the ſeveral Parts of a fortify'd Place are pretty well deſcribed, and the Plate belonging to this *Art* comprehenſive, and done according to the beſt of the modern Ways.

The Figures alſo of the Five Orders of Pillars in *Civil Architecture*, are, I hope, as inſtructive as they could be of that Size; and as for the Terms of Art here, I took them from the beſt Authors, as *Vitruvius*, *Vignola*, *Palladio*, and the *Parallel* by Mr. *Evelyn*.

Navigation is alſo largely treated of, and the whole *Art* taught under the Words *Plain* and *Mercator*'s *Sailing and Traverſes*: And as to the *Variation of the Compaſs*, I have given you a very full and exact Account of it, from the excellent Mathematician Capt. *Halley*, together with his Ingenious Hypotheſis for the Solution of its Variation; and Practical Rules to find the Variation of the Compaſs at Sea.

And as to a *Ship*, I have endeavoured to be very full and particular in deſcribing the ſeveral Parts of her, both in the *Dock*, when *Building*, and when *Rigg'd*, and *under Sail* at Sea: For I have conſulted the beſt *Draughts*, *Sections* and *Models* I could get a Sight of, have got what Helps I could from Captains and Maſters of Ships, and have often gone on Board my ſelf, to get the more ready Knowledge of this Affair; and I have compared it all with what we have already printed of this Nature in Books and Deſcriptions of Ships; ſuch as *Manwaring*'s *Sea Dictionary*, *Boteler*'s *Sea Dialogues*, *Philips*'s *Section of a Firſt Rate*, &c.

I have given alſo, from ſeveral Eminent Hands, and ſeveral Ways, the *Laws of Motion*: As from Dr. *Wallis*, Sir *Iſaac Newton*, Monſieur *Varignon*, Mr. *John Keil*, &c.

And the Doctrine of *Mechanicks*, *Nature* and *Properties* of *Staticks*, the Laws of *Pendulums*, and of *Projectiles*.

And I have been very large in that moſt uſeful Science *Hydroſtaticks*, giving an Account of the Principles and Practice of the *Art*, both Mathematically and Experimentally: And under the Word *Specifick Gravity*, I have given you all that the Honourable Mr. *Boyle* hath advanced on that Subject, in his *Medicina Hydroſtatica*; to which a large Table of the *Specifick Gravities* of different Bodies is added; and all his *Hydroſtatical Paradoxes* are inſerted in their proper Places.

I have deſcribed alſo, chiefly from Mr. *Derham*, the Way of Calculation of *Automata*, or Clock and Watch-work; and explained the Terms of *Art* uſed in *Painting* and *Sculpture*.

As to *Phyſick* and *Natural Philoſophy*, and thoſe admirable Helps to the underſtanding of Nature, which *Geometry*, applied to Phyſical Enquiries, hath of late afforded us, and to which indeed we are chiefly indebted to that prodigious Mathematician Sir ISAAC NEWTON, I have endeavoured to give you every where the Marrow and Subſtance of it under proper Heads: And under the Term of *Art*, or *Word*, expreſſing any particular Quality, I have collected all I could meet with to explain it, and to clear up its Nature and Properties; as you will find at large under ſuch Words as *Electricity*, *Solidity*, *Elaſticity*, *Effluviums*, *Magnetiſm*, *Light* and *Colours*, &c. As to which laſt, I am ſorry I had not Time to take no more from Sir *Iſaac Newton*'s excellent Book of *Opticks* lately publiſhed; what I could, I have inſerted, as I had before done the Subſtance of what he had publiſhed in the *Philoſophical Tranſactions* on that moſt noble Subject; and which convinces us that we were all miſtaken in our Notions about it before, for want of proceeding in a right Method of Enquiry.

Here is in particular, a Diſcourſe of Natural Secretion; alſo Diſcourſes on Thunder, a *Vacuum*, Vapours, and Water; with a large Account of Sounds, Echoes, the Tranſmutation of Bodies into one another; the Nature of Light and Colours; the Rays of Light, the double Refraction found in the Iſland Cryſtal; of *Elaſticity*, *Electricity*, the Coheſion of Parts of Bodies, *&c.*

You have here alſo an Account of that amazing Property, the Attraction of the Particles of Matter one towards another, firſt diſcovered by that incomparable Mathematician Sir *Iſaac Newton*, who by wonderful Diſcoveries he hath made about the Nature of Light and Colours, hath opened a new World in Natural Philoſophy, as by his Method of Fluxions, *&c.* he had before done in Mathematicks, Mechanicks, and Aſtronomy; and hath ſufficiently ſhewn, that what he ſaid in his Preface to his *Principia Philoſ. Math.* in theſe Words: *Multa me movent ut nonnihil ſuſpicer cætera naturæ Phœnomena, ex* *viribus quibuſdam pendere poſſe, quibus corporum particulæ, per cauſas nondum cognitas, vel in ſe mutuo impelluntur, et ſecundum Figuras regulares cohærent, vel ab invicem fugantur et recedunt*, was what he very well knew *then*, though expreſſed with that Caution and Modeſty, as was ſo peculiar to that excellent Man.

This was printed in the Year 1687, and the Queries at the End of his *Opticks*, and eſpecially as ſince enlarged by him in the *Latin* Tranſlation of it, do ſufficiently ſhew his Thoughts to have been long ago employed on this moſt uſeful Subject, and from whence thoſe Propoſitions took their Riſe; which thoſe ingenious and induſtrious Brothers the *Keils*, have publiſhed about this Affair of *Attraction*: But however, to do the illuſtrious Author yet further Juſtice, I have, with his Leave, at the End of this Preface, or rather Introduction, printed a *Latin* Paper of his *de Acido*, with a Tranſlation of my own, and which, though never publiſhed before, was given by him to a Friend as long ſince as the Year 1692, which I wiſh had come to my Hands ſooner, to have been inſerted in this *Lexicon*, under their proper Head, *Acids.*

And give me Leave further to inform the Reader, that there was, at the printing of my Second Volume, a *Latin* Mathematical Treatiſe or two of Sir *Iſaac Newton*'s, which were written many Years ago, and which, by their Date, will ſufficiently determine, whether the new Method of *Fluxions* were known firſt to him or Mr. *G. Leibnitz.*

The *Phænomena* of the *Rainbow*, or *Iris*, are here accounted for from the learned and ingenious Capt. *Halley*, now Savilian Profeſſor of *Geometry* in *Oxon.*

The Account of *Snow* I give you from Dr. *Crew*; and one of *Ice* from the *French.*

I have collected what I could meet with as to *Sound*; but I wiſh that Quality were a little better conſidered.

You have here a very full Account of all the *Phænomena* and *Properties* of the *Air* and *Atmoſphere*, as its Gravity, Spring, or Elaſticity, *&c.* and a full Deſcription of, and the Uſe of ſuch Inſtruments as have been invented to enable us to judge of them; as the *Barometer*, *Thermometer*, *Hygrometer*, &c. all which is chiefly from the Honourable Mr. *Boyle*, and the *Philoſophical Tranſactions.*

The Account of *Springs* and *Fountains* is from Capt. *Halley* and Dr. *Woodward*; and from the former of theſe learned and ingenious Gentlemen, I have given you a new Theory of *Tides*, or a Solution of the *Phænomena* of the Ebbing and Flowing of the *Sea*, which is very plain, certain, and intelligible, and built on Sir *Iſaac Newton*'s Principles.

In *Botany*, I have been as large as I could be, without giving Deſcriptions of Plants, which is contrary to my Deſign: But you have here, from our Mr. *Ray*, *Morriſon*, and Monſieur *Tournefort*, I believe, a pretty exact *Botanick Lexicon*, which was what we really wanted before: Together with an Account of all the ſeveral Kinds and ſubalternate Species of Plants, and their ſpecifick Differences; in which I have followed Mr. *Ray*'s Method, as appearing to me to be the beſt and moſt natural.

A Table of *Foſſils* I have given you from the accurate Dr. *Woodward*, Profeſſor of Medicine in *Greſham* College; and a Scheme of Metals and Stones from Biſhop *Wilkins*'s Real Character.

I have alſo given you a large Account of *Vegetation*, which is very curiouſly and exactly done from the Experiments and Obſervations of Dr. *Woodward*.

You have here alſo a good Account of the Nature and Property of the *Wind*, from Capt. *Halley*; and a Deſcription of Mr. *Papin*'s *Wind-Gun*, from Mr. *Boyle*.

From which laſt excellent Gentleman I have alſo taken what I ſay about the Nature and Properties of *Cold*.

And likewiſe from Capt. *Halley* and Sir *Iſaac Newton*, is collected all that which you will find under the Word *Heat*.

In *Chymiſtry*, the Knowledge of which is one great Help towards the underſtanding of Nature, I have been large and particular; explaining the Chymical Principles, Veſſels, and Degrees of Fire; and have omitted no Proceſs nor Operation of Uſe, that I could either meet with in Books, or get from my Friends; as the Reader will ſoon ſee, by conſulting the Book it ſelf, under ſuch Words as *Phoſphorus*, *Bolonian Stone*, *Sympathetick Inks*, *Tranſmutation*, &c.

In *Anatomy* I have been very large and full, deſcribing all the Parts of an human Body, both internal and external. Here are alſo inſerted pretty large Accounts of the Ear, Stomach, Spleen, Skin, *Vena Porta*, Lungs, Gall, and Reſpiration, and of the new Theory of Generation; with Deſcriptions of the Lymphaducts and Glands, and two very fine Copper-plates of the Veins and Arteries of a human Body, which were drawn from the original Tables preſented by that great Promoter of uſeful Learning, *John Evelyn of Deptford*, Eſq; to the Royal Society of *London*; and I hope the Deſcriptions, in moſt Places, will prove tolerably accurate and inſtructive; eſpecially under ſuch general Words as *Blood*, *Circulation*, *Bones*, *Heart*, *Ear*, *Eye*, *Viſion*, *Arteries*, *Veins*, *Bile*, *Lympha*, *Chylification*, &c. in all which I have conſulted the beſt Authors.

In *Logick*, *Metaphyſicks*, *Ethicks*, *Grammar*, *Rhetorick*, &c. I have been deſignedly ſhort; giving uſually the bare Meaning only of the Words and Terms of Art, with one or two Inſtances to explain them, and illuſtrate them.

In *Hiſtory* and *Chronology*, you have what properly belongs to them as *Arts*; as an Account of the *Civil* Computation of Time; the Original and Reduction, one to another, of the ſeveral *Æra*'s, *Epocha*'s, *Periods*, *&c.*

In *Heraldry*, I have given you the entire *Art* of *Blazoning* and *Marſhalling* a *Coat of Arms*; and explained all the Ordinaries, Charges, Bearings, *&c.* by Figures: But have ſaid nothing of Families (any further, than that ſuch a Coat belongs to ſuch a Name) my Deſign being only to explain the *Art* and its *Terms*.

As to the Deſcription of the *Mathematical* and *Philoſophical* Inſtruments; ſome of them (as the moſt uſeful) are largely done, but the others as briefly: For as it would have taken up a large Volume to have deſcribed them all; ſo for many of them, the Reader would not have been much the better. But the *Globes* and *Quadrants* are largely treated of, as are *Teleſcopes*, *Microſcopes*, *Baroſcopes*, *Hygroſcopes*, and the *Pneumatick Engines*, or *Air-pumps*; becauſe theſe are of vaſt Uſe and Benefit to Mankind, and have ſerved to improve and raiſe up the Knowledge of Nature to that good Height it is now arrived to, and I hope will carry it yet much further.

I have been very full and particular in *Aſtronomy*, having not only from Mr. *Hayes*'s excellent Book of Fluxions given a ſhort Syſtem of the New Aſtronomy, but have alſo from the ingenious and learned Mr. *Halley*, Savilian Profeſſor of Geometry in the Univerſity of *Oxford*, inſerted a *Synopſis* of the Doctrine of Comets; and from the Prelections of Mr. *Whiſton*, Mathematick Profeſſor of the Univerſity of *Cambridge*.

And becauſe I would have theſe two Volumes to ſerve as a Kind of ſmall Mathematical Library, and prevent in ſome Meaſure the Neceſſity and Charge of buying many Books on theſe Subjects; I have here alſo given a full and clear Account of all the Lines which are uſually drawn on any Mathematical Inſtruments, Rules, Scales, *&c.* and how to uſe thoſe Inſtruments, on which they are drawn, in the ſeveral Parts of Practical Mathematicks for which they were deſign'd.

And I have here and there inſerted ſuch uſeful Tables for the Calculation of Intereſt, Annuities, Purchaſes, Reverſions, *&c.* as I found moſt eaſily and readily ſubſervient to thoſe Uſes.

Here is alſo an Account of the Method of *Levelling*, in order to drain Marſhes, Fens or Moraſſes, or to convey Water from one Place to another.

An Account of the Riſe, Invention, and Progreſs of the *Art of* PRINTING; with a Deſcription of the Tools and Inſtruments ſubſervient thereunto.

I have added alſo a farther Account of the Phaenomena of Priſms and the Rainbow; with a ſhort Syſtem of Opticks from Sir *Iſaac Newton*; and many Improvements in Microſcopes and Teleſcopes; the Art of Perſpective, and the Methods of Projective, Reflective and Refractive Dialling.

In *Mechanicks*, beſides the Account of the Five Powers and Demonſtrations of the Nature and Principles of that Science, here are many things added about Centres of Gravity and Oſcillation, the Reſiſtance of Mediums, with the Deſcription and Uſes of all ſuch mechanical Inſtruments, Tools and Engines, as are uſed in Architecture, Fortification, Gunnery, or any mathematical Arts and Sciences.

In *Geometry*, here are great additional Improvements; as two Treatiſes of the Order and Quadrature of *Curves*, written by the incomparable Sir *Iſaac Newton*; a Treatiſe of Conick Sections, tranſlated from the poſthumous Book of the Marqueſs *de L'Hoſpitall*, with many other Things relating to the Properties of Curves, ſcattered up and down under particular Words; ſuch as *Cycloid*, *Helicoid*, *Retrogreſſion of Curves*, *Tranſcendental Quantities*, *&c.* Here are alſo added many new Things in Arithmetick and Algebra, and in the Doctrine of Fluxions; as about *Alternations*, *Combinations*, the Laws of *Chance* in Play, *Infinite Series*, and *Political Arithmetick*; and about the Roots of *Equations*, Renewing of *Leaſes*, *Reverſions*, *&c.*

I have alſo here given a large Account of the Ways of Finding, Dreſſing, Melting, *&c.* of all the ſeveral Ores from whence our Metals are taken; deſcribing alſo the Works, Engines, Tools, and Terms of Art uſed by Miners; as alſo the Ways of making Salt, Allum, Copperas, Vitriol, and ſuch like mineral Productions.

In *Muſick*, here is given an Account of the Nature and Grounds of Harmony, from Dr. *Holder*, and a new ſhort Syſtem of Muſick by the ingenious Mr. *Perk.*

In *Navigation*, I have added many Things; as the Way of finding and allowing for the Setting of Currents; an Account of the Power of the Winds on the Sails of Ships, and of the Signals uſed at Sea, both by Day and Night, in Sailing, and in an Engagement; together with a new Traverſe Table, and its Uſe and Application: And at the End you will find two very accurate Cuts of the Inſide and of the Rigging of a Firſt Rate Man of War, with the ſeveral Parts deſcribed, and referr'd to by proper Letters and Numbers.

I have alſo added a Copper Plate, deſcribing a new *Hydroſtatical Balance*, which is very ready and expeditious to find the Specifick Gravity of Bodies, as is there ſhewn.

I have here, under the Word *Microſcrope*, given the Reader the Figure, Nature, Uſe and Advantages of Mr. *Wilſon's* Glaſſes of that Kind, which I think my ſelf oblig'd to ſay, are the moſt ready, commodious, and univerſally uſeful of any Microſcopes I ever ſaw.

And I have likewiſe given a Plate of a new *Sextant*, made by the Hand of that excellent Mathematical Inſtrument-maker Mr. *John Rowley*, for the Obſervatory in *Trinity College* in *Cambridge*; which, for its Mathematical Uſe, far exceeds any Aſtronomical Inſtrument I ever ſaw. You have likewiſe an Explanation of it.

As to the *Law Part* of the Dictionary, I did my ſelf actually conſult the beſt Books and Dictionaries I could get recommended to me; and from thence I tranſcrib'd abridgedly, all that ſeem'd neceſſary to be inſerted here; and ſince that, I have had it carefully examined and corrected by a Gentleman of known Ability in that Profeſſion.

And thus having given you a ſhort Account of what you may expect to find in this Work, and which may perhaps ſatisfy the Reader that it is a Book uſeful to be *read carefully over*, as well as to be conſulted, like other Dictionaries, occaſionally: I have only one Thing more to acquaint the Reader with, and that is, That the ingenious and accurate Mr. *Derham*, late Rector of *Upminſter* in *Eſſex*, and Fellow of the Royal Society, hath obtained from *Florence* an Account of the Meaſures and Weights uſed there; and we find by Menſuration and Tryal, that the *Florentine Semibroccio*, or half Brace, is in Length 11.475 of our Inches, or in Foot Meaſure .956 of our Foot; and the *Florentine* Ounce is 17 Penny Weight 12 Grains and three Fourths of a Grain *Troy* Weight.

The following Paper of Sir Iſaac Newton*'s, is excellently well worth the Philoſophical Reader's moſt ſerious and repeated Peruſal; for it contains in it the Reaſon of the Ways and Manner of all Chymical Operations, and indeed of almoſt all the Phyſical Qualities, by which natural Bodies by their ſmall Particles act on one another.*

De Natura Acidorum

Iſ. Newton, 1692.

‘ACIDORUM Particulæ ſunt aqueis craſſiores, et propterea minus volatiles, at terreſtribus multo ſubtiliores, et propterea multo minus fixæ. Vi magna attractiva pollent, et in hoc vi conſiſtit earum activitas, quâ et corpora diſſolvunt et organa Senſuum agitant et pungunt. Mediæ ſunt naturæ inter aquam et corpora terreſtria, et utraque attrahunt. Per vim ſuam attractivam congregantur circum particulas corporum, ſeu lapideas, ſeu metallicas; iiſque undique adhærent arctiſſime, ut ab iiſdem deinceps per diſtillationem vel ſublimationem vix poſſint ſeparari, attractæ vero et undique congregatæ, elevant, disjungunt et diſcutiunt particulas corporum ab invicem, id eſt corpora diſſolvunt; et per vim attractionis qua ruunt in particulas commovent fluidum et ſic calorem incitant, particulaſque nonnullas adeo diſcutiunt ut in aerem convertant et ſic bullas generant. Et hæc eſt ratio diſſolutionis et fermentationis; acidum vero attrahendo aquam æque ac terram efficit ut particulæ diſſolutæ prompte miſceantur cum aquâ, eique innatent ad modum ſalium. Et quemadmodum Globus Terræ per vim gravitatis attrahendo aquam fortius quam corpora leviora efficit ut leviora aſcendunt in aquâ, et fugiant de terrâ. Sic Particulæ Salium attrahendo aquam fugant ſe mutuo, et ab invicem quam maxime recedendo per aquam totam expanduntur.

‘Particula Salis alkali ex terreis et acidis ſimiliter unitis conſtant; ſed hæ acidæ vi maxima attractivâ pollent, ut per ignem non ſeparentur a Sale; utque metalla diſſoluta præcipitant attrahendo ab ipſis particulas acidas quibus diſſolvebantur.

‘ Si Particulæ acidæ minore proportione cum terreſtribus jungantur, ut ab iis ſupprimi ac occultari videantur. Neque enim ſenſum jam pungunt, neque attrahunt aquam; ſed corpora dulcia et quæ cum aqua ægre miſcentur, hoc eſt *pinguia* componunt; ut in *Mercurio dulci*, *Sulphure communi*, *Luna Cornea*, et *Cupro* quod *Mercurius ſublimatus* corroſit. Ab acidi vero ſic ſuppreſſi vi attractivâ fit ut *pinguia* corporibus prope univerſis adhæreant, et flammam facile concipiant ſi modo acidum calefactum inveniat alia corpora in fumo accenſorum quæ fortius attrahat quam propria. Sed et acidum in ſulphureis ſuppreſſum fortius attrahendo particulas aliorum corporum (ſcilicet terreas) quam proprias Fermentationem lentam et naturalem ciet et fovet uſque ad Putrefactionem compoſiti.

‘ Quæ Putrefactio ſita eſt in eo quod acidæ Fermentationem diu foventes tandem in interſtitia minima et *primæ Compoſitionis* partes interjacentia ſeſe inſinuant intimeque iis partibus unitæ mixtionem novam efficiunt non amovendam nec cum priore commutandam.

Cogitationes variæ ejuſdem.

‘ Flamma eſt fumus candens, differtque a fumo, ut ferrum rubens ab ignito ſed non rubente.

‘ Calor eſt agitatio partium quaquaverſum.

‘ Nihil eſt abſolute quieſcens ſecundum partes ſuas, et ideo frigidum, præter atomos, vacui ſcilicet expertes.

‘ Terra augetur aquâ in eam converſa, et omnia in aquam (vi ignis) reduci poſſunt.

‘ Nitrum abit diſtillatione magnam partem in Spiritum acidum relictâ terrâ, quia acidum nitri attrahit Phlegma; et idcirco ſimul aſcendunt, conſtituuntque Spiritum: At nitrum carbone accenſum magnum partem abit in *Sal Tartari*, quia ignis eo modo applicatus partes acidi et terræ in ſeſe impingit fortiuſque unit.

‘ Spiritus ardentes ſunt Olea cum Phlegmate per Fermentationem unita.

‘ Tinctura *Cochinellæ* cum Spiritu Vini facta in aquæ magnum molem immiſſa, parva licet doſi totam aquam inficit: ſcilicet, quia Particulæ *Cochinellæ* magis attrahuntur ab aqua quam a ſe mutuo.

‘ Aqua non habet magnam vim diſſolvendi, quia pauco acido gaudet. Acidum enim dicimus, quod multum attrahit et attrahitur: Videmus nempe ea quæ in aquâ ſolvuntur lente et ſine effervescentiâ ſolvi, et ubi eſt attractio fortis et particulæ menſtruis undique attrahuntur a particulâ Metalli, vel potius particula metalli

‘ undique attrahitur a particulis Menſtrui, hæ illam abripiunt et circumſiſtunt, hoc eſt Metallum corrodunt: Hæ eadem particulæ ſenſorio applicatæ ejus partes eodem modo divellunt, dolorem inferunt; a quo acidæ appellantur, relictâ ſcilicet terrâ ſubtili cui adhærebant ob majorem attractionem ad liquidum linguæ, *&c.*

‘ In omni Solutione per Menſtruum Particulæ ſolvendæ magis attrahuntur a Partibus Menſtrui quam a ſe mutuo.

‘ In omni Fermentatione eſt Acidum ſuppreſſum quod coagulat præcipitando.

‘ Oleum cum nimis magna mole Phlegmatis intime mixtum, fit Salinum quiddam et ſic Acetum conſtituit, hic etiam Tartari ſeu Terræ admiſtæ habenda eſt ratio.

‘ *Mercurius* attrahitur, id eſt, corroditur ab Acidis et ſicut pondere obſtructiones tollit ita vi attractrice Acida infringit.

‘ *Mercurius* eſt volatilis et facile elevatur calore, quia ejus Particulæ *ultimæ Compoſitionis* ſunt parvæ et facile ſeparantur ſeparatæq; ſeſe fugant; ut ſit in Particulis Vaporis, Fluidorumq; rarefactorum.

‘ Aqua comprimi non poteſt, quia ejus Particulæ jamjam ſe tangunt. Et ſi ſe tangerent Particulæ Aeris (nam Aer comprimi poteſt, quia ipſius Particulæ nondum ſe tangunt) Aer evaderet in Marmor. *Seq. ex Prop.* 23. *Lib.* 2. *Princ. Philoſoph.*

Aurum Particulas habet ſe mutuo trahentes; minimarum ſummæ vocentur *primæ Compoſitionis*, harum ſummarum ſummæ *ſecundæ Compoſitionis*, *&c.*

‘ Poteſt *Mercurius*, poteſt *Aqua Regia* Poros pervadere, qui Particulas *ultimæ Compoſitionis* interjacent at non alios.

‘ Si poſſet Menſtruum alios illos pervadere, vel ſi Auri Partes *primæ et ſecundæ Compoſitionis* poſſent ſeparari fieret Aurum, vel Fluidum, vel Saltem magis malleabile. Si Aurum fermenteſcere poſſet in aliud quodvis corpus poſſet transformari.

‘ Viſciditas eſt vel ſolum defectus Fluiditatis, quæ ſita eſt in partium parvitate et ſeparabilitate (intellige partes *ultimæ Compoſitionis*) vel defectus lubricitatis ſeu lævioris partes unius ſupra alias labi impediens. Hujus Viſciditatis Acidum ſæpe cauſa eſt; ſæpe Spiritus alius lubricus terræ junctus, ut Oleum Terebinthinæ capiti ſuo Mortuo redditum fit tenax.

‘ Ratio cur Charta Oleo inuncta tranſitum Oleo non Aquæ concedat eſt quia Aqua Oleo non miſcetur ſed fugatur ab eo.

‘ Cum Acidæ Partes, minores ſcilicet, aliquid diſſolvunt, id faciunt, quia partem rei ſolvendæ includunt undique utpote Majorem quâlibet Acidi Partium.

Some Thoughts about the NATURE of ACIDS: By Sir ISAAC NEWTON.

THE Particles of Acids are of a Size groſſer than thoſe of Water, and therefore leſs volatile; but much ſmaller than thoſe of Earth, and therefore much leſs fixed than they. They are endued with a great attractive Force; in which Force their Activity conſiſts; and thereby alſo they affect and ſtimulate the Organ of Taſte, and diſſolve ſuch Bodies as they can come at. They are of a middle Nature between Water and Terreſtrial Bodies, and attract the Particles of both.

By this attractive Force they get about the Particles of Bodies, whether they be of a Metallick or Stony Nature, and adhere to them moſt cloſely on all Sides; ſo that they can ſcarce be ſeparated from them by Diſtillation or Sublimation. When they are attracted and gathered together about the Particles of Bodies, they raiſe, disjoin, and ſhake them one from another; that is, they diſſolve thoſe Bodies.

By their attractive Force alſo, by which they ruſh towards the Particles of Bodies, they move the Fluid, and excite Heat; and they ſhake aſunder ſome Particles, ſo much as to turn them into Air, and generate Bubbles: And this is the Reaſon of Diſſolution, and all violent Fermentation; and in all Fermentation there is an Acid latent or ſuppreſs'd, which coagulates in Precipitation.

Acids alſo, by attracting Water as much as they do the Particles of Bodies, occaſion that the diſſolved Particles do readily mingle with Water, or ſwim or float in it, after the Manner of Salts.

And as this Globe of Earth, by the Force of Gravity, attracting Water more ſtrongly than it does lighter Bodies, cauſes thoſe lighter Bodies to aſcend in the Water, and to go upwards from the Earth: So the Particles of Salts, by attracting the Water, do mutually avoid and recede from one another as far as they can, and ſo are diffuſed throughout the whole Water.

The Particles of *Sal Alkali* do conſiſt of *Earthy* and *Acid* united together, after the ſame Manner: But theſe Acids have ſo great an attractive Force, that they can't be ſeparated from the Salt by Fire; they do alſo precipitate the Particles of Metals diſſolved in *Menſtrua*, by attracting from them the acid Particles, which before had diſſolved them, and kept them ſuſpended in the *Menſtruum*.

If theſe acid Particles be joined with earthy ones, in but a ſmall Quantity, they are ſo cloſely retained by them, as to be quite ſuppreſs'd and hidden as it were by them; ſo that they neither ſtimulate the Organ of Senſe, nor attract Water, but compoſe Bodies which are not acid, *i. e.* Fat and Fuſible Bodies, ſuch as are *Mercurius dulcis*, *Common Brimſtone*, *Luna Cornea*, and *Copper* corroded by *Mercury Sublimate.*

From the attractive Force in theſe acid Particles thus ſuppreſs'd, ariſes that univerſal Property of almoſt all Fat Bodies, that they adhere or ſtick to others, and are eaſily inflammable, if the heated acid Particles meet with other Particles of Bodies in Fume, which the acid attracts more ſtrongly, than it doth the Particles to which it is united. And thus the Acid that lies ſuppreſs'd in ſulphureous Bodies, by more ſtrongly attracting the Particles of other Bodies, (Earthy ones for Inſtance) than its own, promotes a gentle Fermentation, produces and cheriſhes natural Heat, and carries it on ſo far ſometimes, as to the Putrefaction of the Compound: Which Putrefaction ariſes hence, That the acid Particles which have a long while kept up the Fermentation, do at long Run inſinuate themſelves into the leaſt Interſtices that lie between the Particles of the *firſt Compoſition*, and ſo intimately uniting with thoſe very Particles, do produce a new Mixture or Compound, which cannot fall back again into the ſame Form.

> Note, *The Paper hitherto deſcrib'd, ſeems to have been a continued Diſcourſe; but what follows are ſhort Minutes of Thoughts relating to the ſame Subject.*

Nitre, in Diſtillation, leaving its Earthy Part behind, turns moſt of it into an acid Spirit; becauſe the Acid of the Nitre attracts the Phlegm, and therefore they aſcend together, and conſtitute a Spirit: But *Nitre*, kindled with a Coal, turns chiefly into a Salt of Tartar; becauſe the Fire applied this Way, drives the acid and earthy Parts towards, and makes them impinge on, and more ſtrongly unite one with another.

The Reaſon why Water hath no great diſſolving Force, is, becauſe there is but a ſmall Quantity of Acid in it: For whatever doth ſtrongly attract, and is ſtrongly attracted, may be call'd an Acid: And ſuch things as are diſſolv'd in Water, we ſee, become ſo, *eaſily*, without any Effervеſcence: But where the Attraction is ſtrong, and the Particles of the *Menſtruum* are every where attracted by thoſe of the Metal, or rather, where the Particles of the Metal are every Way attracted by thoſe of the *Menſtruum*; then the Particles of the *Menſtruum* environ thoſe of the Metal, tear them to pieces, and diſſolve it.

So when theſe acid Particles are applied to the Tongue, or to any excoriated Part of the Body, leaving the ſubtile Earth in which they were before, they ruſh into the Liquid of the Senſory, tear and disjoint its Parts, and cauſe a painful Senſation.

Mercury is attracted, and therefore corroded by Acids; and as it opens Obſtructions by its great Weight; ſo it breaks and obtunds the Power of Acids (in the Body) by its attractive Force.

All Bodies have Particles which do mutually attract one another: The Summs of the leaſt of which may be called Particles of the *firſt Compoſition*, and the Collections or Aggregates ariſing from the *Primary Summs*; or the Summs of theſe Summs may be called Particles of the *ſecond Compoſition*, &c.

Mercury and *Aqua Regis* can pervade thoſe Pores of Gold or Tin, which lie between the Particles of *its laſt Compoſition*; but they can't get any further into it; for if any *Menſtruum* could do that, or if the Particles of the *firſt*, or perhaps of the *ſecond Compoſition* of Gold could be ſeparated; that Metal might be made to become a Fluid, or at leaſt more ſoft. And if Gold could be brought once to ferment and putrefy, it might be turn'd into any other Body whatſoever.

And ſo of Tin, or any other Bodies; as common Nouriſhment is turn'd into the Bodies of Animals and Vegetables.

> N.B. *The ſmall Difference which there is between this Tranſlation and the* Latin *above, was its being taken from another Copy a little different from this* Latin *Paper. And having been ſuperviſed and approved of by the illuſtrious Author, I have not altered it ſince.*

And as to whatſoever Improvements and Additions ſhall be hereafter, as I queſtion not but Time will produce, if God pleaſe to bleſs me with Health and Leiſure, theſe ſhall be printed.

Thus far the Author.

But ſince it may be expected that we ſhould give ſome Account of what has been done by Way of Improvement and Addition in this Edition: We anſwer in general, that we have endeavoured to do what the Author himſelf intimated he deſigned to do, had he not been prevented by Death. But to be more particular.

In the Firſt Place, Whereas the former Editions were in two diſtinct Alphabets, each Volume in one, ſo that many, if not moſt of the Articles of the Firſt Volume, ended incomplete, and required that the Second muſt alſo be conſulted for the additional Matter, which was no ſmall Inconvenience and Trouble to the Peruſer: In this Edition, the two Alphabets are brought into one, and thoſe Additions in the Second Volume are ſubjoined immediately after the Firſt; and ſo the Marter carried on in a continued Series.

Secondly, Whereas there have been, ſince the Publication of the former Editions of theſe Volumes, various and conſiderable Improvements made in the Arts and Sciences treated of in them; theſe additional Improvements are here added to thoſe Articles to which they properly belong.

Thirdly, We have here added many *Technical* Words and Terms of Art not to be found in the former Editions of this Work.

Fourthly, As to thoſe *Technical* Words and Terms of Art that were in them before, and alſo ſuch as are added, we have likewiſe given their Etymologies from the *Latin* and *Greek* Tongues, which frequently are explanatory, and give an Idea of the Arts or Things themſelves.

Fifthly, Though the Additions here inſerted are too numerous to be particularly mentioned, yet that we might neither ſwell them to an unweildy Bulk, nor enhance the Price, we have made Room for them, by throwing out various Tables of Aſtrological or Aſtronomical Calculations, which having been calculated for a certain Number of Years only, long ſince expired, they were now of no Uſe at all; and as for thoſe of Logarithms, Sines, Tangents, &c. which are very common, and eaſy to be had for a ſmall Price, and in ſmaller Volumes, we were of Opinion they might better give Place to more uſeful Matter.

Sixthly, We have likewiſe added to this Edition, beſides wooden Prints, a Number of new Copper Plates of ſeveral Improvements in

Natural Philoſophy, Mechanicks, Mathematicks, *&c.* curiouſly engraven.

And though theſe Volumes do not, in Bulk, equal ſome others of the ſame Kind, ſo neither do they in Price; yet we hope, that by Reaſon of the proportional Quantity of uſeful Matter they contain, they will be little (if at all) inferior to others of a more cumberſome Size, and much greater Price.

The EDITORS.

LEXICON TECHNICUM:

OR, AN

UNIVERSAL *ENGLISH*

DICTIONARY

OF

Arts and Sciences.

ABACOT, the Cap of State, uſed in old time by our *Engliſh* Kings, wrought up in the Figure of two Crowns.

ABACTORS, [*Abactores*, *L.*] the ſame with *Abigei*, ſuch as ſteal and drive away whole Flocks of Cattle; or the greateſt Part of any Herd or Flock; in which the Lawyers diſtinguiſh them from *Fures*, who only ſteal a Sheep or two, *&c.*

ABACUS, [Ἄβακος, Gen. of Ἄβαξ, *Gr.* It was uſed among the Ancients for a Cupboard or Boufet.

ABACUS was a Name given by the Ancients to a Compting-Table uſed in Calculations. This was ſometimes a Board covered with Sand, Duſt, *&c.* ſifted evenly upon it, on which Geometricians, *&c.* uſed to draw their Schemes. Hence,

ABACUS *Pythagoricus*, [i. e. *Pythagoras*'s Table] is a Table of Numbers contriv'd for the more eaſy learning the Principles of Arithmetick, and, by ſome, is ſuppoſed to be the Multiplication-Table.

ABACUS [in *Architecture*] is the uppermoſt Member or Capital of a Column, which ſerves as a ſort of Crowning both to the Capital and Column; tho' ſome erroneouſly make it to be it ſelf the Capital.

ABACUS [according to *Vitruvius*] was originally deſigned to repreſent a ſquare Tile laid over an Urn or Basket. The Original Riſe of this regular Order of Architecture is ſaid to be as follows:

An old Woman of *Athens* having placed a Baſket, covered with a Tile, over the Root of an *Acanthus* [i.e. *Bear's-foot*] the Plant ſhooting forth the following Spring, encompaſſed the Basket all round, till having met the Tile, it curled back in a kind of Scroll; which being obſerved by an ingenious Sculptor, he formed a Capital upon this Plan, repreſenting the *Tile* by the *Abacus*, the *Basket* by the *Vaſe* or Body of the Capital, and the *Leaves* by the *Volutes*.

The ABACUS is ſomething different, in different Orders. It is a flat ſquare Member in the *Tuſcan*, *Dorick*, and ancient *Ionick* Orders.

In the richer Orders, the *Corinthian* and *Compoſite*, it loſes its native Form, having its four Sides or Faces arched or cut inwards with ſome Ornament, as a Roſe, ſome other Flower, a Fiſh's Tail, *&c.*

But there are other Liberties taken in the *Abacus* by ſeveral Architects; ſome make it a perfect *Ogee* in the *Ionick*, and crown it with a Fillet.

In the *Dorick* ſome place a *Cymatium* over it, and ſo do not make it the uppermoſt Member.

In the *Tuſcan* Order, where it is the largeſt and moſt maſſive, and takes up one third Part of the whole Capital, they ſometimes call it the *Die of the Capital.* And

Scamozzi uſes the Name *Abacus*, for a concave Moulding in the Capital of the *Tuſcan* Pedeſtal.

ABAFT, AFT, [Abaꝼꞇan or Apꞇan, *Sax.*] a Sea Term, ſignifying always thoſe Parts which are towards the Stern of the Ship: So they ſay, ſuch a Maſt hangs *Aft* or *Abaft*, that is, towards the Stern. And becauſe the Maſter's or Captain's Cabbin is uſually in the hinder Part of the Ship under the Quarter-Deck, 'tis a common Compliment to a Perſon come on Board a Ship, *Sir, will you pleaſe to walk Aft.*

ABALIENATION, a Term in the old *Roman* Law, ſignifying a ſimple Sale of the Goods of one Citizen to another: Theſe Goods were called *Res mancupii*, or *mancipii*; and were Eſtates either in

Slaves or Cattle, and ſometimes Land of Inheritance; but they muſt be in *Italy*.

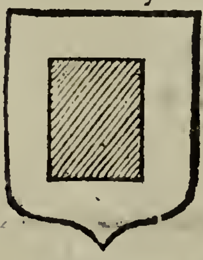
ABAPTISTON, ANABAPTISTON, ['Αβαπτιςον 'Αναβαπτιςον, *Gr.*] an Inſtrument uſed by Surgeons, a Sort of Trepan, the ſame with *Modiolus*, which ſee.

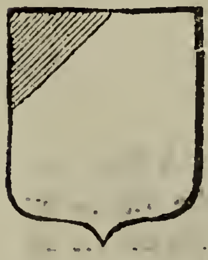
ABARTICULATION [with *Anatomiſts*] that Species of Articulation that has manifeſt Motion.

ABASE, [*abbatre*, *F.*] in the Sea Language, is to *Lower* or *Take in*. *To Abaſe the Flag*, is to take in the Flag.

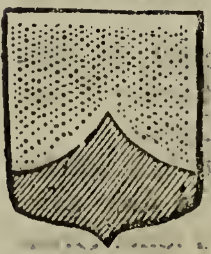
To ABATE, ſignifies in Law to take Poſſeſſion of Land by a Perſon that hath no Right to it, after the Death of the Anceſtor, and before the Entry of the right Heir. Alſo to *Abate a Writ*, ſignifies to deſtroy it for a Time, thro' want of good Ground, or other Defect. So to *Abate a Nuſance*, is to deſtroy it, &c.

ABATEMENT *of Honour*, in Heraldry, is an accidental Mark annexed to a Coat of Arms, whereby its Dignity is abaſed by reaſon of ſome diſhonourable Quality or Stain in the Bearer, and it is either by adding a *Mark of Diminution*, or by *Reverſion* of the whole Eſcutcheon. The *Marks of Diminution* are, 1. A *Delf Ten*, which is a Square born in the middle of the Field, thus; and belongs to one that hath revoked his Challenge, or eaten his Words.

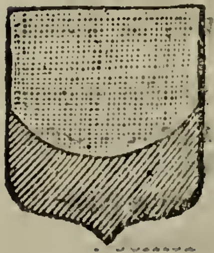




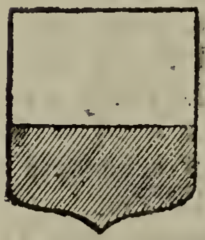
2. A *Point Dexter parted Tenn*: due to him that is a *Braggadocio*, or boaſts of more than he did, or can do.



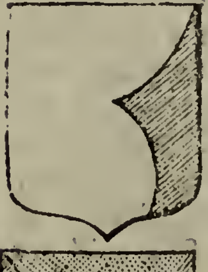
3. A *Point in Point Sanguine*, thus; due to him that is Lazy and Slothful in the Wars.



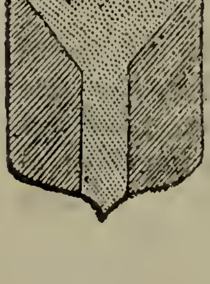
4. A *Point Champain Tenn*: which is due to him that kills his Priſoner after Quarter demanded, and his Commander's Leave to give it; born thus.



5. A *Plain Point Sanguine*, born thus; due to one that is a Lyar, and tells falſe Stories to his Sovereign.

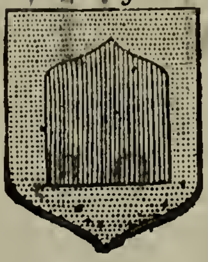


6. A *Goar Siniſter Tenn*, born thus; and is due to him that is proved a Coward: But a *Goar Dexter* is not an Abatement.



7. A *Guſſet Sanguine*, born thus; where are two Guſſets one on each Side. The Guſſet is an Abatement proper for an effeminate, laſcivious Man; and is then born on the right Side; but if he be given to too much Wine, the Guſſet is on the left Side; if to both, he ſhould bear two Guſſets, as in this Example.

Reverſion is two-fold; 1. When a Man bears in his own Eſcutcheon another Reverſed, as thus; which is due to a rude and uncivil Treater of Maid or Widow; or as ſome ſay, for deflowring her only; and alſo, for one that runneth away from his Sovereign's Banner.



2. When a Man's own Eſcutcheon is entirely Reverſed, which is due to a Traitor.

N. B. Theſe Abatements are never charged with any thing; are always born ſingle, and their Colour is never of Metal, but always either *Murrey* or *Tawney*.

ABATEMENT [in *Law*] the Act of abating, defeating, or diſabling; alſo the entring of an Inheritance, by ſtepping in between the former Poſſeſſor and the next Heir.

ABATOR, [in the *Common Law*] is he that *abateth*, that is, intrudeth into a Houſe or Land void by the Death of the former Poſſeſſor, and not yet entred, or taken up by his Heir.

ABBACY, is the Government of a Religious Houſe, with the Revenues and Perſons ſubject to an *Abbat*.

ABBAT, [Aboꝺ, Abuꝺ, *Sax.*] is a Spiritual Lord, having the Rule of Religious Houſes, (according to our Common Law). Some *Abbats* in *England* were called *Mitred Abbats*; and ſuch were exempted from the Juriſdiction of the Dioceſan, having Epiſcopal Authority themſelves within their Limits, and were alſo Lords of Parliament. Theſe were ſometimes call'd *Abbats Sovereign*, and *Abbats General*. The other *Abbats* were ſubject to the Dioceſan in all Spiritual Government. There were alſo *Lords Priors*, which had exempt Juriſdiction, and were Lords of Parliament. Of theſe *Lords Abbats* and *Priors*, Sir *Edw. Coke* ſaith there were 29 that ſat in Parliament, 27 *Abbats*, and 2 *Priors*. But ſometimes their Number was varied, there being but 25 *Abbats* and 2 *Priors* in a Parliament held in the 20 *Rich.* 2.

ABBROCHMENT, is the Fore-ſtalling of a Market or Fair, by buying up the Wares before they are expoſed to Sale in ſuch Market or Fair, and then vending them again by Retail.

ABBUTTALS, [of *abouter*, *F.*] are the *Buttings* and *Boundings* of Lands any Way, ſhewing how they lie in reſpect to other Places.

ABDICATION, a Term of the *Roman* Law, ſignifying ſeveral Things; as the abandoning of a Son, when he was expell'd his Father's Houſe, and refuſed to be owned as his Child. *Abdicare Magiſtratum*, or *ſe magiſtratu*, was to abandon or lay down the Office of a Magiſtrate. We meet there alſo with *Abdicare ſe ſtatu ſuo*, which ſignifies a Man's renouncing his Condition to become a Slave, and to be degraded from the Privileges of a *Roman* Citizen.

ABDICERE, ſignifies to debar a Man from his Demands, or not to allow them: Thus *Abdicere vindicias*, was in the *Roman* Law, not to allow a Man the Poſſeſſion of Things in Controverſy, as *addicere vindicias* is the very contrary.

Though the Word *Abdication* ſignifies ſtrictly an actual and voluntary Renouncing, yet in a larger Senſe, at Common Law, it may be properly uſed where there is only an *implicit Renunciation*; as when a Perſon does ſuch Actions which are inconſiſtent with the Nature of his Truſt, he does in Conſequence renounce it; and this was the late famous Caſe of a certain Prince, where this known and ancient Common-Law-Term was revived, though indeed it is more generally uſed among the Civilians.

ABDOMEN, [of *abdo*, to hide, or, as others will have it, of *abdo* and *omentum*, *L.* the Caul.] the lowermoſt of the three *Venters* in an human Body; properly the *Lower Belly*: It contains in its Region the Stomach, Guts, Liver, Spleen, Bladder, *&c.* Within it is covered with a Membrane called the *Peritonæum.* The lower Part of it is called the *Hypogaſtrium.* The foremoſt Part is divided into the *Epigaſtrium*, the Right and Left *Hypochondria*'s, and the Navel. 'Tis bounded above by the *Cartilago enſiformis* and the *Diaphragm*, ſideways by the ſhort or lower Ribs, and behind by the Vertebres of the Loins, the Bones of the *Coxendix*, *Pubis*, and *Os Sacrum.* It hath ten Muſcles, which both cover it, and ſerve to excrete the *Fæces* and *Urine*, and to expel the *Fœtus* in Women: You will find them under their proper Names.

ABDUCTION, [with *Anatomiſts*,] a Term uſed when the Ends of the Bones ſtand at a great Diſtance in a Fracture.

ABDUCTOR, a Leader or Drawer away, from *L.* Hence,

ABDUCTOR *Indicis*, is a Muſcle of the Fore-finger, which is not to be ſeen till the *Abductor Pollicis* is raiſed; by ſome it is reckoned amongſt the *Interoſſei*; it ariſes fleſhy from the *Os Metacarpi* that ſuſtains the Fore-finger, and deſcending over the firſt Internode of the ſaid Finger, becomes tendinous, joyning with the Tendon of one of the Lumbrical Muſcles, and is inſerted with it together with the Tendon of the former Muſcle. Its Name intimates its Uſe, in drawing the Fore-finger from the reſt.

ABDUCTOR *Oculi*, a Muſcle of the Eye, ſo called from its Action in retracting or drawing off the Eye from the Noſe: It is alſo called *Indignabundus*, becauſe it is made uſe of in ſcornful Reſentments.

ABDUCTOR *minimi digiti*, is a Muſcle which appears in ſome Bodies divided into two or three Muſcles, having each a differing Series of Fibres; the firſt of which ſeems to be a *Flexor primi Internodii minimi digiti*; the ſecond an *Abductor* of the ſame; the third *Abductor ſecundi & tertii Internodii*; but this Diviſion is not conſtant. It ariſes fleſhy, firſt, from the *Ligamentum tranſverſale* and fourth Bone of the *Carpus*; ſecondly, from the third Bone of the *Carpus*; and then, thirdly, from the ſuperior Parts of the ſubjacent *Os Metacarpi*: The two firſt continue fleſhy to their Inſertions; the former terminating at the ſuperior Part of the firſt Bone of the Little-finger forwards; the latter ending at the ſame Part of the ſaid Bone laterally; the third, becoming tendinous like the *Interoſſei*, is inſerted like them with the Tendon of the *Extenſor minimi digiti* at the ſuperior Part of the third Bone of the Little-finger. Its uſe is to draw the Little-finger from the others.

ABDUCTOR *Pollicis*, is a Muſcle of the Thumb, which ariſes broad and fleſhy from the internal Part of the *Ligamentum tranſverſale Carpi*, whence deſcending it leſſens it ſelf, and becomes tendinous at its Implantation to the ſuperior and external Part of the ſecond Bone of the Thumb laterally. This draws the Thumb from the Fingers, from whence it derives its Name.

ABDUCTOR *Pollicis Pedis*, is a Muſcle which ariſes fleſhy from the *Os Calcis* internally and laterally, in half its Progreſs becoming tendinous, it joins with another fleſhy Beginning, ſpringing from the *Os Cuneiforme majus* that ſuſtains the *Os Metatarſi* of the Great Toe; both which making one Tendon, are inſerted to the external Part of the *Os Seſamoides* of the Great Toe laterally. This pulls the Great Toe from the reſt.

ABDUCTOR *minimi Digiti Pedis*, is a Muſcle which ariſeth outwardly tendinous, but inwardly fleſhy, from the external Part of the *Os Calcis*, becoming tendinous in half its Progreſs on the Outſide of the Foot; it joins with the other fleſhy Part of this Muſcle ariſing fleſhy from the Outſide of the *Os Metatarſi* of the Little Toe, and making one Tendon at its Inſertion to the upper Part of the firſt Bone of the Little Toe externally and laterally. Its Uſe is to draw off the Little Toe from the reſt.

ABDUCTORES, in the general, are the ſame with *Abducent Muſcles.*

ABDUCENT *Muſcles*, are univerſally thoſe which ſerve to open or pull back divers Parts of the Body, as the Arms, Legs, Eyes, Noſtrils, Lips, *&c.* Theſe are called alſo *Abductors.* Their Oppoſites are uſually called *Adductors*, or *Adducent Muſcles.*

ABEARING, [in *Law*,] Behaviour, as *to be bound to a good Abearing*, is to be bound to a good Behaviour.

ABELITION, the Licence given to a Criminal Accuſer, to deſiſt from further Proſecution.

ABETMENT, [in *Common Law*,] is the Act of encouraging or ſetting another to commit a Crime.

ABETTORS, is a common Law Term, and ſignifies thoſe that without Cauſe procure others to ſue out falſe Appeals of Murder, or Felony againſt Men, in order to render them infamous.

ABETTORS, in Murder, are thoſe which adviſe or procure a Murder to be committed; in the ſame Senſe there are Abettors in Felony and Treaſon; in the laſt of which they are all *Principals*, there being no Acceſſories in Treaſon.

ABEYANCE, [in *Law*,] ſignifies a Thing's being *in Poſſe* only, and not in *Actu.* Thus ſuppoſe a Leaſe made to *A.* for Term of Life, and the Remainder to the right Heir of *B.* who is living at the Time of the Grant; in this Caſe, tho' the Remainder paſs preſently from the Grantor, yet it veſts not preſently, or takes hold in the Grantee, that is the Heirs of *B.* but is Indeterminate, *in Potentia*, *in Nubibus*, in *Abeyance*, *viz.* in Conſideration of Law: So when the Parſon of a Church dies, and the Church is void, the Fee is in *Abeyance*, becauſe it is not determined who ſhall ſucceed him.

ABINTESTATE, [in *Law*,] an Heir to a Perſon who died without a Will.

ABJURATION, formerly was an Oath which a Perſon who had committed Felony, and who, to avoid the Law, had betaken himſelf to Sanctuary, took to depart the Kingdom for ever (the Perſon having confeſſed his Crime before a Juſtice or Coroner, and abjured the Kingdom, was to carry a Croſs in his Hand, till he got out of the King's Dominions): It was a Law enacted by *Edward* the *Confeſſor*, but is ſince changed by the Statutes, 21 *H.* 8. *c.* 12. But the Senſe of the Word *Abjurare*, originally, in the *Roman* Language, as uſed by *Cicero* and other good Writers of that Age, was, *To deny a Thing upon Oath*; to deny that a Man had *promiſed*,

miſed, *committed*, *detained*, or *did owe* any thing, upon his Oath. Thus with him *Abjurare Creditum* was to forſwear a Debt, or to deny on Oath that he ow'd the Debt.

ABLACTATION, the weaning of a Child that hath ſucked its full Time. Alſo a kind of Grafting, when the Cyon remaineth on its own Stock, and the Stock you graft it on, together, till ſuch Time as they are ſurely incorporated ; then the Cyon is cut from its *own*, and lives only by the other Stock.

ABLAQUEATION, a laying open or baring the Bottom of the Trunk and Roots of Trees, that ſo being expoſed to the Air, the Sun and the Rains, they may the better fructify, or bear Fruit the enſuing Year.

ABLATIVE *Caſe*, is the laſt of the ſix Caſes of Nouns and Participles in Grammar, and is ſo called becauſe it uſually takes away one thing from another. 'Tis called alſo the *Latin Caſe*, becauſe almoſt peculiar to the *Latin* Tongue, and is uſually connected with ſome Prepoſitions, which ſerve to determine it.

ABLEPSY, [Ἀβλεψία, *Gr.*] Want of Sight, natural Blindneſs.

ABLUTION, (properly a waſhing away) the Preparation of a Medicine in any Liquor, to cleanſe it from its Impurities.

ABLUENT *Medicines*, are the ſame with *Abſtergent* ; which ſee.

ABNODATION, in *Agriculture*, ſignifies the pruning of Trees, and cutting off Knots and Knobs.

ABOLITION, in *Metaphyſicks*, is an utter Deſtruction of any Being.

ABOLITION of a *Law*, is the perfect repealing it, or the entire taking of it away, ſo that it ſhall never have Force again.

ABOMASUS, OMASUM, (the *Paunch*) one of the Stomachs of *Ruminant* Animals, or ſuch as chew the Cud ; of which are reckoned four, the *Venter*, *Reticulum*, *Omaſus*, and *Abomaſus*. *L.*

ABORIGINES, are ſuch Nations as the *Italians*, who pretend anciently to be without Original or Derivation from any other Nation or People.

ABORTION, [of *Aborior*, *L.* to riſe or ſpring up untimely,] the bringing forth of a Child (or *Fœtus*) before its due Time.

ABORTIVE, is ſpoken of a *Fœtus* brought forth before its Time: Hence it is alſo an Epithet given to any Deſign or Purpoſe that miſcarries.

ABRASION, [with *Surgeons*] a ſuperficial raiſing of the Skin.

ABRENUNCIATION, is a renouncing or forſaking of any thing entirely.

ABREVIATIONS, are Contractions in Writing, or otherwiſe, whereby any thing that is written or ſpoken, is contained in, or takes up much leſs Room than it would do, if written or delivered at large.

ABREUVOIRS, are the Intervals or Spaces between the Stones, or the Joints where the Mortar lies in any Pillar, Wall, or Building, *F.*

ABRIC, with ſome Chymiſts, the ſame with *Sulphur.*

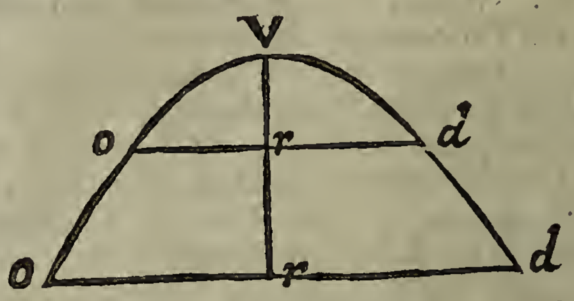
ABRIDGMENT of a Plaint, in Common Law, is, when one Part of the Plaintiff's Demand is left out, and it is prayed that the Defendant may anſwer to the other.

To ABROGATE, ſignifies to diſannul or repeal ; as to *Abrogate* a Law, is to lay it aſide, or to repeal it. So that the

ABROGATION of a Law, is the repealing it, or taking it quite away.

ABSCESS, [*Abſceſſus*, *L.*] an Ulceration ariſing in any Part of the Body after a *Criſis* : The ſame with *Apoſtema.*

ABSCISSÆ, in a Conick Section, or other Curvilineal Figure, are the Parts of the Axis cut off by the Ordinates, and accounted downwards from the Vertex of the Section. Thus *V r* or *V R* are the *Abſciſſæ* in this Figure. Theſe are called by ſome Writers, the *Intercepted Axes*, or *Intercepted Diameters.*



ABSIS, the ſame with *Apſis* ; which ſee.

ABSOLUTE : This Word, (which ſignifies, Free from the Power of another) is variouſly uſed. Sometimes the Terms of a Propoſition are ſaid to be taken *abſolutely*, that is, without Relation to any thing elſe. A Prince is ſaid to be *abſolute*, when he makes his *Will* his *Law*, and will in no reſpect be reſtrained or limited by the Laws of his Country. This is otherwiſe called Arbitrary Power ; and ariſes from an Imperfection both in the Underſtanding of the Prince, and in the Spirits of the People. But God Almighty is *abſolute* from the Perfection of His Nature, as containing in Himſelf all poſſible Power, and lying under no Limitations nor Reſtraints from any one. *Abſolute* is ſometimes taken alſo in Oppoſition to Terms or Conditions ; thus God doth not forgive Men their Sins *abſolutely*, but on Condition of their Repentance and Amendment ; and a Prieſt cannot abſolve Men from the Guilt of their Sins *abſolutely*, but only declaratively and miniſterially, on the Condition of the Perſon's Penitence and Reſolutions for Amendment. So (in Law) an *Abſolute* Eſtate is one free from all Manner of Conditions.

ABSOLUTE *Eſtate*, [in *Law*,] is an Eſtate free from all Manner of Conditions and Incumbrances.

ABSOLUTE *Number*, in an Equation in *Algebra*, is that which *Vieta* calls the *Homogeneum Comparationis*, and which always poſſeſſeth one entire Part or Side of the Equation, and is always a known Quantity ; and the Rectangle or Solid, under the unknown Roots, in Quadraticks and Cubicks : Thus in this Equation $aa+16a=36$. The Abſolute Number is 36, which is equal to the Square of the unknown Root a, added to 16 times a: Again, in this Equation $x^{0}+20x^{2}-10x=100$, 100 is the Abſolute Number, which is equal to $x^{3}+20x^{2}-10x$, which is a Cubick Equation. See *Equations.*

ABSOLUTE *Equation*, in *Aſtronomy*, is the Aggregate or Sum of the Eccentrick and Optick Equations. See *Equation.*

ABSOLUTE *Motion*, is the Succeſſion of the Exiſtence of Bodies in divers Parts of univerſal and immoveable Space. See *Motion.*

ABSOLUTE *Place*, is Part of the univerſal Space immoveable, and occupied by Body. See *Place.*

ABSOLUTE *Gravity*, is the whole Force by which any Body tends downward. See *Gravity.*

ABSORBENTS, are Medicines that temper and qualify the acid Juices in the Body, by imbibing

bing or drinking them up. Thus *Alkali*'s are ſaid by ſome to abſorb Acids.

ABSTENSION, [in *Law*] is a with-holding an Heir from taking Poſſeſſion of his Land.

ABSTERGENT, or *Abſterſive* Medicines, are ſuch as are uſed to clear the Skin or ſuperficial Parts of the Body from any Filth, *&c.* obſtructing its Pores.

ABSTERSION, is the Effect produced by abſterſive Medicines, or in general, any cleanſing or wiping away.

ABSTRACTION, is a Power peculiar to the Mind of Man, in Contradiſtinction to the Souls of Beaſts, and plainly diſtinguiſhes him from them; whereby he can make his Ideas, ariſing from particular Things, become general Repreſentatives of all of the ſame Kind. Thus, if my Eye repreſents to me Whiteneſs in a Wall, I can *abſtractedly* conſider that Quality of Whiteneſs, and find it attributable to many other Things beſides, as to Snow, to Milk, or the like; and this Quality, whatever it be, thus conſidered apart from the *Concrete*, or the Subject in which it inheres, is ſaid to be taken in the Abſtract.

ABSTRACT, is frequently uſed alſo for a ſmall Draught or Epitome of any greater Work.

ABSTRACT *Idea*; (*See* Idea.)

ABSTRACT *Numbers*, are thoſe which are conſidered as *pure Numbers*, without being applied to any Subject.

ABSTRUSE, ſecret, dark, not eaſily intelligible.

ABUNDANT *Numbers*, are thoſe whoſe Parts added together, make more than the whole Number which they are Part of; as *v.g.* Twelve, whoſe Parts being 1, 2, 3, 4, and 6. theſe all added together make Sixteen: Thus alſo the Parts of 20 make 22, *&c.*

ABSIS, ſee *Apſis.*

ABUSE *of Words.* In this Kind, the firſt and moſt palpable Abuſe is, the uſing of Words, without clear and diſtinct Ideas; or which is worſe, Signs without any thing ſignified. Of theſe there are two Sorts:

1. One may obſerve, in all Languages, certain Words, that, if they be examined, will be found, in the firſt Original, and their appropriated Uſe, not to ſtand for any clear and diſtinct Ideas. Theſe, for the moſt Part, the ſeveral Sects of Philoſophy and Religion have introduced. For their Authors, or Promoters, either affecting ſomething ſingular, and out of the Way of common Apprehenſions, or to ſupport ſome ſtrange Opinions, or cover ſome Weakneſs of their Hypotheſis, ſeldom fail to coin new Words, and ſuch as, when they come to be examined, may juſtly be called inſignificant Terms.

2. Others there be, who extend this Abuſe yet farther, who take ſo little Care to lay by Words, which in their primary Notation have ſcarce any clear and diſtinct Ideas which they are annexed to, that by an unpardonable Negligence, they familiarly uſe Words, which the Propriety of Language has affixed to very important Ideas, without any diſtinct Meaning at all.

ABYSS, is any vaſt deep Place, which either hath no Bottom, or elſe hath none diſcernable, or at leaſt is ſuppoſed to have none.

The learned Dr. *Woodward*, in his *Natural Hiſtory of the Earth*, p. 117. tells us, That there is a mighty Collection of Waters incloſed in the Bowels of the Earth, conſtituting an huge Orb in the interior or central Parts of it; and over the Surface of this Water, he ſuppoſes the terreſtrial *Strata* to be expanded: This is what *Moſes* calls the *Great Deep*, and what many Authors call the *Abyſs*. And that there is ſuch a vaſt Collection of Waters lodged in the Bowels of the Earth, is confirmed by Abundance of Obſervations.

The Water of this vaſt Abyſs, the Doctor aſſerts, doth communicate with that of the Ocean, by Means of certain Holes, *Hiatus*'s, or *Chaſms* paſſing betwixt it and the Bottom of the Ocean: And this and the Abyſs he ſuppoſes to have one common Centre, around which the Water of both of them is placed; but ſo, that the ordinary Surface of the Abyſs is not level with that of the Ocean, nor at ſo great a Diſtance from the Centre as that is, it being for the moſt Part reſtrained and depreſſed by the *Strata* of Earth lying upon it; but whereever thoſe *Strata* are broken, or ſo lax and porous that Water can pervade them, there the Water of the Abyſs doth aſcend, fills up all the Clefts or *Fiſſures* whereinto it can get Admittance or Entrance, and ſaturates all the Interſtices and Pores of the Earth, Stone, or other Matter all around the Globe, quite up to the Level of the Ocean.

ACADEMY, is a kind of higher School or Univerſity, where young Men are inſtructed in the Liberal Arts and Sciences. 'Twas ſo called at firſt from *Academia*, the Name of a Place near *Athens*, and built, ſay ſome, by *Cadmus* the *Phœnician*; others, by one *Academus*, whence it had its Name: 'Twas planted with Trees; and here *Plato* taught his Diſciples Philoſophy, who from hence are called *Academicks.* *Cicero* alſo call'd one of his Country Seats by this Name, where he had fine Groves, and pleaſant Walks for the Entertainment of his Philoſophical Friends; and here he wrote his Books, *De Nat. Deorum*, and *De Amicitia*, and his *Offices*; which therefore he called his *Academical Treatiſes.*

ACADEMICKS; ſo the Followers of *Plato* were anciently called, becauſe they ſtudied in the *Academia*. Afterwards it became the Name of a Sect of Sceptical Philoſophers, who maintained, That all Things were uncertain, and that Reaſon and Truth were changeable, ſo that Men ought to doubt of every thing, and believe nothing.

ACANTABOLUS, ['Ακανταβολος, of ἄκανθα and βαλλω, *Gr.* to *caſt out.*] the ſame with *Volſella*, (excepting that the *Volſella* is crooked) a Surgeon's Inſtrument to take out any thing that ſhall happen to ſtick in the *Oeſophagus* or Gullet; 'tis ſomething like a Pair of Plyers, and may be reckoned as a kind of *Forceps.*

ACANTHA, [Ἄκανθα, *Gr.* a *Thorn.*] is with ſome Anatomiſts the moſt backward Protuberance of the Vertebres of the Back; and is otherwiſe called *Spina Dorſi.*

ACARNAR, the ſame with *Acherner.*

ACATALECTICK *Verſe*, is one exactly perfect, where not ſo much as one Syllable is either redundant or deficient.

ACCAPITARE [in *Law*] is to pay Relief to the chief Lord.

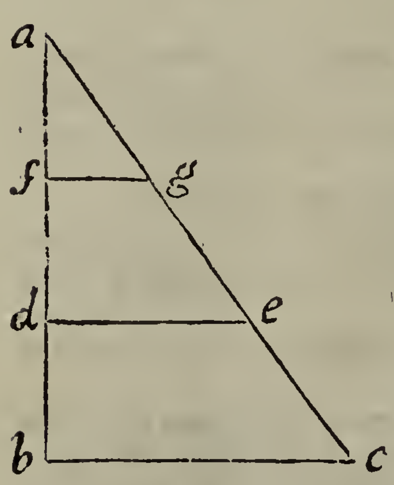
ACCEDAS *ad Curiam*, a Writ made out of the Chancery, and returnable in the King's Bench or Common Pleas, and directed to the Sheriff, requiring him to go to the Court of ſome Lord, or Franchiſe, (where a Plaint is ſued for taking of Cattle as a Diſtreſs, or any falſe Judgment ſuppoſed to be made in any Suit in ſuch a Court, which is not a Court of Record) and there make a Record of the ſaid Suit, in Preſence of the Suitors of the ſaid Court, and alſo of four other Knights of the ſame County; and to certify it unto the King's Court, at the Day limited in the Writ.

ACCEDAS *ad Vice Comitem*, is a Writ directed to the Coroner, requiring him to deliver a Writ to the Sheriff, who having a *Pone* delivered to him, ſuppreſſes it.

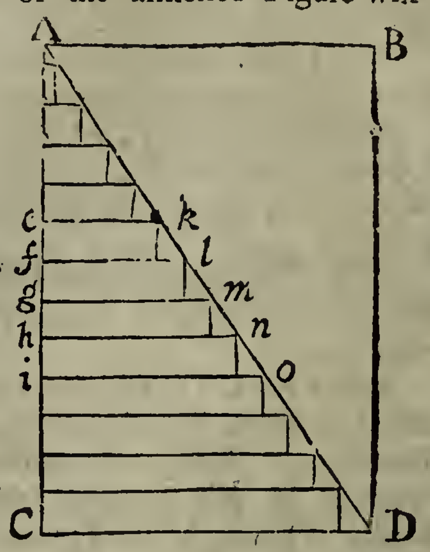
ACCELERATION of the Deſcent of heavy Bodies was firſt diſcovered by *Galilæus*: And if due Attention be given to our excellent Sir *Iſaac Newton*'s Second Law of Motion, *Axiom*, or *Law of Nature*, as it may be called, *viz. That the Mutation of Motion is always proportionable to the Force impreſſed, and always is according to that ſame Line of Direction*, the Reaſon of the Acceleration of the Deſcent of heavy Bodies, will be very clear and intelligible.

For, ſuppoſing Gravity (whatever it be) to act uniformly on all Bodies, at equal Diſtances from the Earth's Centre, and that the Time in which any heavy Body falls to the Earth, be divided into equal Parts infinitely ſmall: Let Gravity encline the Body towards the Earth's Centre, while it moves in the firſt infinitely ſmall Part of the Time of its Deſcent: If after this, the Action of Gravity be ſuppoſed to ceaſe, the Body would go towards the Earth's Centre equally, with a Velocity equal to the Force of that firſt Impreſſion, (by Sir *Iſaac*'s firſt Axiom.) But now ſince the Action of Gravity ſtill continues; in the ſecond Moment of Time the Body will receive a new Impulſe downward, and then its Velocity will be Double of what it was in the firſt Moment: In the third Moment or Particle of Time, it will be Triple; in the fourth Quadruple, and ſo on continually. Wherefore ſince thoſe Particles of Time are ſuppoſed infinitely ſmall, and all equal to one another, the *Impetus* acquired by the Falling Body, will be every where as the Times from the Beginning of the Deſcent. And ſince the Quantity of Matter in the Body given, continues the ſame, the Velocity will be as the Time in which it is acquired (as you will find proved in the *Laws of Motion.*)

And after the ſame Manner may it be proved, That the Motion of Aſcending Projectives ſhall be equally retarded; for ſince the Force of Gravity acts continually and equally againſt the Motion firſt begun, it muſt diminiſh or abate the Motion, according to the Time of the Aſcent, till at laſt it wholly ceaſe.



Let the Right Line *a b* expreſs the Time of any heavy Body's Deſcent, and let *b c* at right Angles to it, denote the Velocity acquired at the End of the Fall. Draw *a c*, and any where the two Parallels *f g*, *d e*, ſo they ſhall expreſs the Velocities acquired in the Times of Deſcent *a f* and *a d*. For becauſe of ſimilar Triangles, *a b. a d* :: *b c. d e* :: and as *a d. a f* :: *d e. f g*. Wherefore, 'tis plain, the Velocities are as the Times of Deſcent; that is, as the Lines or Elements of the Triangle *a b c*, drawn parallel to the Baſe *b c*.



The Conſideration of the annexed Figure will teach us, *That if an heavy Body be thus uniformly accelerated in its Deſcent, the Space which it deſcribes from the Beginning of the Time of its Motion, ſhall be juſt the half of that which it would have deſcribed, had it gone on for the ſame Time with a Velocity equal to what it had acquired in the End of its Fall.*

Let (as before) *A C* repreſent the Time of the Deſcent, *D C* the Velocity at laſt acquired; and compleat the Triangle *A C D*. Let alſo the Time *A C* be diſtinguiſhed into an indefinite Number of ſmall Parts, as *e f*, *f g*, *g h*, *h i*, &c. and draw the Parallels *e k*, *f l*, *g m*, *h n*, *i o*, &c. to the Baſe *C D*. Then will *e k* be as the Velocity of the heavy Body, in the infinitely ſmall Part of Time *e f*, and *f l* will be the Velocity in the ſmall Time *f g*, &c.

But now it is proved in the Laws of Motion, (ſee that Word) That the Space or Length deſcribed by any moving Body, in any given Time, and with a given Celerity; is *as the Rectangle under the Time and the Celerity*, wherefore the Space deſcribed in the Time *e f*, with the Celerity *e k*, will be as the Rectangle *f k*; and the Space deſcribed in the Time *f g*, with the Celerity *g m*, will be as the Rectangle *g l*, &c. wherefore the Space run through in the Sum of all theſe Times, will be as the Sum of all the Triangles; that is, as the Triangle *ACD*, which contains them all. Again, the Space run through by the deſcending Body in the Time, *A C*, with the uniform Celerity *D C*, (*by the 7th Article of Mr.* Keil's Laws of Motion *above referred to*) will be as the Rectangle *A B C D*. Wherefore the Space run over by the deſcending Body in the given Time, and uniformly accelerated, is to the Space deſcribed by the ſame Body, in the ſame Time with an uniform Celerity equal to what it at laſt acquires :: as the Triangle *A D C* is to the Rectangle *A B C D*. But the Triangle is one half of the Rectangle; wherefore the Space deſcribed by the accelerated deſcending Body from the Beginning to the End of its Motion, in a given Time, is juſt the half of the Space which would be deſcribed by the ſame Body, if it had gone on, for the ſame Time, with a Velocity equal to what it had acquired in the End of its Fall. *Q. E. D.*

From whence it will follow, 1. That the Space run over with the Velocity *C D* in half the Time *A C*, will be equal to the Space deſcribed by the falling accelerated Body, in the whole Time *A. C.*

2. As the Triangle *A C D* repreſents the Space paſſed through in the Time *A C*, ſo the Triangle *A i o*, will repreſent the Space deſcribed by the falling Body in the Time *A i*; and the Triangle *A e k*, will repreſent that deſcribed in the Time *A e*, &c. Wherefore,

3. 'Tis plain, the Spaces deſcribed, or the Diſtances run through in the Fall, will always be as the Squares of the Times: For the ſimilar Triangles *A C D*, *A i o*, *A e k*, &c. are to one another as the Squares of their homologous Sides *A c*, *A i*, *A e*.

4. Wherefore if a heavy Body deſcending from its Place of Reſt, deſcribe any Length in a given Time, in twice that Time it will deſcribe four times the Length; in thrice the Time, nine times the Length, &c. Or, in other Words, if the Times are conſidered in Arithmetical Proportionals, 1, 2, 3, 4, 5, &c. the Spaces deſcribed will be 1, 4, 9, 16, 25, &c.

5. Since the Space in the firſt Part of Time is 1, in the ſecond 4, in the third 9, &c. if you conſider the Space run through in the ſecond Particle of Time ſeparately, it will be as 3; and from 9, the Space deſcribed in the third Part of Time, you take 4, the Space before deſcribed in the ſecond Moment, there will remain 5, &c. wherefore ſuppoſing the Moments or Parts of Time equal, the Spaces deſcribed by the Deſcent of an heavy Body beginning from Reſt, in each Moment conſidered ſeparately, will be as the natural odd Numbers, 1, 3, 5, 7, 9, 11, 13, 15, 17, &c.

6. And ſince the Velocities acquired in falling, are as the Times, the Spaces run through will be alſo as the Squares of the Velocities; and both Times and Velocities will be in ſubduplicate *Ratio* of the Spaces deſcribed by any falling Body.

This is confirmed by the following Experiments.

The Balance *AB* (Fig. 1.) which has but one Scale, is exactly *in Æquilibrio*, when a Weight is put into the Scale, in Iron made in the Form of a *Gnomon*, keeps faſt the *Brachium A*, and the Balance is retained in an Horizontal Poſition.

At *f* there is a thin Spring *fg* fixed to the *Gnomon*, and which, when extended, reaches to *i*, where the End *g* is retained by the Help of the little Plate *i*, which is made faſt to the *Brachium A*. Now by this Means, the leaſt Motion of the Balance becomes ſenſible, becauſe then the Spring *f g* being free, flies out, and returns to the Figure *fg*.

At the End of the *Brachium B* there is a Hole, through which the String faſtned to the Hook *D* paſſes freely, that String is kept in a vertical Situation by hanging on the Weight *N*.

The Weight *M* has a Hole through it, for the above-mentioned String to paſs freely through; in making Experiments, the Weight *M* is raiſed up along the String, and when you let it go, it falls upon the ſame Point of the *Brachium B*.

Experiment.] Put the one Pound Weight *P* into the Scale, then the Body *M* falling from the Height of three Inches, will move the Balance. When *P* is a two Pound Weight, let *M* fall from 12 Inches, and the Balance will be moved. If you lay on three Pounds in the Scale, the Body *M* muſt be let fall from a Height of 27 Inches to move the Balance and raiſe *P*. And in all theſe Caſes, if the Height from which *M* falls be taken but a little leſs, the Balance, with the Weight in the Scale, will not be moved.

In this Experiment, the Weight which is laid upon the Scale, and raiſed by the Blow of the falling Body, is proportionable to the Stroke; the Quantity of Motion in the Body follows the Proportion of the Stroke: And that Quantity (becauſe we make uſe of the ſame Body) is proportionable to the Celerity: And *Laſtly*, the Celerity here is proportioned to the Time of the Fall: Therefore, the Weights above-mentioned follow the ſame Proportion of the Time. The Weights here are as the natural Numbers 1, 2, 3, and therefore the Times are in that Proportion: But the Spaces gone thro' in thoſe Times, are as 3, 12, 27, or as 1, 4, 9, which Numbers are the Squares of the others.

Having divided the Time *AB* (Fig. 2.) into the equal Parts *A* 1, 12, 23, 3 *B*, thro' the Diviſions, draw Lines parallel to the Baſe; the Spaces gone through in thoſe Parts of Time, that is, in the firſt, ſecond, and third Moment, &c. ſuppoſing the Moments equal, are to one another as the Areas *A* 1 *f*, 1 *f g* 2, 2 *g h* 3, 3 *h E B*, which Areas, as appears by the Figure, are to one another as the odd Numbers 1, 3, 5, 7.

If the Body, after it has fallen during the Time *AB*, ſhould be no more accelerated, but with the Celerity *BE*, acquired by that Fall, ſhould uniformly continue its Motion during the equal Time *B C*, the Space gone through by that Motion is expreſſed by the Area *B E D C*, which is double the Triangle *ABE*. And therefore,

A Body falling freely from any Height with that Velocity which it has acquired by that Fall, will, in a Time equal to the Time of the Fall, (by an equable Motion) run thro' a Space double the ſaid Height.

Which Proportion we ſhall alſo confirm by an Experiment.

The Motion of a Body thrown upwards is retarded in the ſame Manner, as the Motion of a falling Body is accelerated by the ſecond Law: In this Caſe, the Force of Gravity conſpires with the Motion acquired; and in that it acts contrary to it. But as the Force of Gravity is equal every Moment, the Motion of a Body thrown up is equally diminiſhed or retarded in equal Times.

The ſame Force of Gravity generates Motion in the falling Body, and deſtroys it in the riſing Body; therefore the ſame Forces are generated and deſtroyed in equal Times. A Body thrown up, aſcends till it has loſt all its Motion; and ſo goes up during the ſame Time, that a Body falling could have acquired a Velocity equal to the Velocity with which the Body is thrown up.

If a Body be thrown up with the ſame Velocity that it would acquire in falling down the Line *B C*, (Fig. 3.) it would aſcend in a Time equal to the Time of the Fall, (and with an equable Motion) ſo as to come up the Height *C A* the Double of *B C*; but as in the ſame Time, by the Force of Gravity, the Body goes through a Space equal to the Space *A B*, or *B C*; as theſe two Motions obtain here at the ſame time, and act contrariwiſe, the leſſer muſt be ſubtracted from the greater; therefore the Body, after the End of the Aſcent, will be at *B*; whence it follows, that a Body thrown up will riſe to the ſame Height, from which, falling, it would acquire the Velocity with which it is thrown up.

And therefore, the Heights which Bodies thrown up with different Velocities can riſe to, are to one another as the Squares of thoſe Velocities.

ACCELERATION *on Inclined Planes*.

We call an *Inclined Plane*, that which makes an Oblique Angle with the Horizon.

C B (Fig. 4.) repreſents a Line parallel to the Horizon; *AB* makes with *A* the Oblique Angle *A B C*, and repreſents an inclined Plane; and the Perpendicular *A C* is let fall from *A*, the upper Part of the Plane, to the Horizon.

The Length *A B* is called the Length of the Plane.

The Line *A C* is called the Height of the Plane.

Let two equal Bodies deſcend by the Force of Gravity from the Point *A*, the one along the Line *AB*, and the other along the Line *A C*: when they are come to the Points *B* and *C* they have deſcended equally, that is, they will be got each equally near to the Earth's Center : Therefore, the Forces with which they are impelled, as they are directed towards the Earth's Centre, are equal ; but the Intenſities of equal Forces are reciprocally as the Spaces gone through, and therefore here the Intenſity of the Force, by which the Body is impelled along an inclined Plane, is to the Intenſity of it, by which it is directly impelled towards the Centre of the Earth, as *A C* to *A B*. Therefore, a Body laid upon an Inclined Plane, loſes Part of its Gravity, and the Weight required to ſuſtain it, is to the Weight of the Body as the Height of the Plane to its Length.

As the Force by which a Body is made to deſcend along an Inclined Plane ariſes from Gravity, it is of the ſame Nature with it ; and therefore that Force every Moment, and in all Parts of the Plane, is equal : For the ſame Reaſon, the Motion of a Body freely running down upon an inclined Plane, is of the ſame Nature with the Motion of a Body freely falling ; and what has been ſaid of the one, may alſo be affirmed of the other. It is therefore a Motion equably accelerated in equal Times ; and therefore the Proportions of Numb. 131, 133, 134, 135, 136, 137, and 138, may be here applied, if we ſuppoſe a Motion upon an Inclined Plane, inſtead of a direct Aſcent or Deſcent.

The Forces by which two Bodies deſcend, one of which falls freely, and the other runs down an Inclined Plane, if the ſaid Bodies begin to fall at the ſame Time, are always to one another in the ſame Ratio as in the Beginning of the Fall ; therefore the Effects of thoſe Forces, that is, the Spaces gone through in the ſame Time, are in the ſame Ratio ; namely, that of the Length of the Plane to its Height.

In the Plane *A B* (Fig. 5.) the Space gone thro' by a Body whilſt another falls freely down the Height of the Plane *A C*, is determined by drawing *C G* perpendicular to *A B* ; for then the Length of the Plane *A B* is to its Height *A C*, as *A C* to *A G*. If a Circle be deſcribed with the Diameter *A C*, the Point *G* will be in the Periphery of the Circle ; becauſe an Angle in a Semicircle, as *A G C*, is always a Right Angle ; and therefore a Point taken, as *G*, in any Inclination of the Plane, will always be in the Periphery of the ſaid Circle : Whence it follows, that all the Chords, as *A G*, are gone through by Bodies running along them, in the Time that a Body falling would freely run down the Diameter *A C* ; and therefore the Times of the Falls thro' thoſe Chords are equal. Through the Point *C* there can be drawn no Chord, as *H C*, but what a Chord, as *A g*, may be drawn parallel to it, (that is, equally inclined) and equal ; therefore in a Semicircle, as *A H C*, whether a Body falls freely along the Diameter *A C*, or whether it falls down along any Chord, as *H C*, it will in the ſame Time come to the loweſt Point of the Semicircle.

The Time of the Fall along the whole Plane *A B*, may be compared with the Time of the Deſcent along the Height *A C* ; which for that Time is equal to the Time of the Fall along *A G*, and ſo the Squares of thoſe Times are to one another, as *A B* to *A G*. But *A B* is to *A C*, as *A C* to *A G* ; therefore the Squares of the Lines *A B* and *A C* are to one another as *A B* to *A G* ; and therefore thoſe Lines *A B* and *A C* are to one another, as the Times of the Fall along *A B* and *A G* or *A C*, that is, the Times in that Caſe are as the Spaces gone through.

In the ſame Caſe, the Velocities at the End of the Deſcent are equal ; for after equal Times, when the Bodies are at *G* and *C*, the Velocities are in the ſame Ratio as in the Beginning of the Fall, that is, as the Forces by which the Bodies are impell'd, or as *A C* to *A B*. When the Body deſcends from *G* to *B*, the Velocity increaſes as the Time ; and the Velocity at *G* is to the Velocity at *B*, as *A C* to *A B* : Therefore the Velocities at *B* and *C* have the ſame Ratio to the Velocity at *G*, and ſo are equal. Hence it appears, that a Body acquires the ſame Velocity, in falling from a certain Height, whether it falls directly down, or along an Inclined Plane ; and ſince the Angle of Inclination cauſes no Alteration, a Body may run down ſeveral Planes differently inclined, and even a long Curve (which may be conſidered as made up of an innumerable Number of Planes differently inclined) and the Celerity acquired will always be the ſame, when the Height is equal.

ACCELERATION *of the Motion of Pendulums*, ſee the Laws thereof under *Pendulum*.

ACCELERATION *of the Motion of Projectiles*, ſee *Projectiles*.

ACCELERATION *of the Motion of compreſſed Bodies in expanding and reſtoring themſelves*, ſee *Percuſſion and Compreſſion*.

ACCELERATORES, [*Anatomy*] certain Muſcles ſo called, of *accelerandi*, i. e. *haſtening*.

ACCELERATORES *Urinæ*, are a Pair of Muſcles belonging to the *Penis*, whoſe Uſe is to expedite the Urine and the *Genitura* : Our accurate Mr. *Cooper* ſaith, Authors have been miſtaken in aſſigning the Origination of theſe Muſcles, either to the *Sphincter Ani*, or to the Tubercles of the *Oſſa Iſchii* : for they ariſe fleſhy from the ſuperior Part of the *Urethra*, as it paſſes under the *Oſſa Pubis*, encompaſſing the external Part of the Bulb of its cavernous Body ; both theſe Muſcles meet on the inferior Part, and march on according to the Length of the Skin in the *Peritonæum*, when parting from each other, they aſcend to their Inſertion on each ſide the *Corpora cavernoſa Penis*. He thinks alſo, that they aſſiſt the *Erectores Penis*, by driving the Blood contained in the Bulb of the cavernous Body of the *Urethra* towards the *Glands* in a greater Quantity, whereby it becomes diſtended : The Veins which carry off the Refluent Blood from the *Corpus cavernoſum Urethræ*, being at that Time compreſſed by the Swelling of theſe Muſcles.

ACCENSION, is the enkindling or ſetting any Body on Fire.

ACCENT in *Grammar*, is a mark placed over a Syllable, to ſhew it is pronounced with a ſtronger or weaker Voice. The *Greeks*, who were the greateſt Obſervers of Accents, diſtinguiſh them into the *Acute one* mark'd thus (′), the *Grave* one thus, (`), and the *Circumflex* thus (˜). But of late one *Hennin*, a *Dutchman*, hath written a Book to prove the Accents were not ancient among the *Greeks*, and that that Language ought not to be pronounced according to them : He pretends no Accents are to be found in any MSS. above 800 Years old, and takes them to be an Invention of the *Arabs* about the Time of *Mahomet*'s Death. He ſays, the *Maſorites* of *Tiberias* brought them into the Bible about the Sixth Century, and that they were perfected by Rabbi *Judah Ben David Chiug*, born in *Fez*, about the Eleventh Century.

ACCENTS in *Grammar*, ſhew how to judge of the Meaſure of Time, in which each Letter, Syllable, Word, or Expreſſion, is pronounced; the Elevations and Depreſſions of the Voice, the Silence or Repoſe of the Voice at the End of Words or Sentences, &c. Theſe Accents may be very numerous: There are in the *Hebrew* Grammars more than thirty of them, and *Servius Honoratus* reckons eight in the *Latin*.

The *Acute Accent* ſhews when the Voice is to be raiſed, and is expreſſed thus, (´).

The *Grave Accent* ſhews when the Voice is to be depreſſed, and is figured thus, (`).

The *Circumflex Accent* is compos'd of both the *Acute* and the *Grave*, and is expreſſed thus, (^)

The *Long Accent* ſhews that the Voice is to ſtop upon the Vowel that has that Mark, and it is expreſſed thus, (¯).

The *Short Accent* ſhews that the Time of Pronunciation ought to be ſhort, and is marked thus, (˘)

Hyphen is an Accent in Grammar, that implies two Words are to be joined, as *male-ſanus*.

Diaſtole, is an Accent in Grammar, which ſhews that thoſe Words or Sentences to which it is adjoyned are to be ſeparated; its Mark is (,).

Apoſtrophe, is an Accent in Grammar, ſhewing there is a Vowel to be rejected, and is expreſſed thus, ('), and placed over the Head of the Letter.

ACCENT *in Muſick*, is a Modulation of the Voice, to expreſs the Paſſions either naturally or artificially.

ACCEPTANCE, *in Law*, is an agreeing to ſome Act already done, without which ſuch Agreement might have been undone or avoided; as if a Man and his Wife ſeized of Land in Right of his Wife, do join and make a Leaſe by Deed, reſerving Rent, and the Husband dying, the Wife *accepts* or receives the Rent: By this Acceptance in her, the Leaſe is made good, and ſhall bar her from bringing a *Cui in vita*.

ACCEPTILATION, *in Civil Law*, is the ſame with *Acquittance* in *Common Law*, being a verbal Diſcharge from the Creditor to the Debtor.

ACCESS, or *Acceſſion*, the Fit or *Paroxiſm* of a Diſeaſe. The Time of being worſt in any Intermittent.

ACCESSIBLE *Height*, is either that which may be mechanically meaſured by the Application of a Meaſure to it, or elſe an Height whoſe Baſe and Foot can be approached to; and from thence a Length meaſured on the Ground. *See Heights*.

ACCESSORIUS *Williſii*, is a Nerve which ariſes from the *Medulla Spinalis*, about the Beginning of the ſixth Pair of the Neck; as it aſcends to the Head, it receives on each Side a Twig from the firſt five Pair of Nerves of the Neck; as they riſe from the *Medulla Spinalis*; then it enters the Skull, and paſſes out of it again with the *Par Vagum*, and is wholly ſpent upon the *Muſculus Trapezius*.

ACCESSORY, *in the Common Law*, is a Perſon adviſing or procuring before the Fact, or aiding and aſſiſting, receiving or protecting after it; one that hath committed Felony; who therefore ſhall have Judgment of Life and Member, as well as the Principal which did the Felony, but not till the Principal be firſt attainted, convict, or outlawed thereupon. A Man alſo may be acceſſory to an Acceſſory, by aiding, receiving, &c. an Acceſſory to Felony. In the *Statute Law*, 'tis ſuch an one as abetts, adviſes, aids or receives one that commits Felony, which is made ſo by Statute.

ACCIDENT: This Word is uſed by Logicians in three Senſes.

1. In Oppoſition to the *Eſſence* of any Thing, whatever doth not eſſentially belong to it, may (though a Subſtance it ſelf) yet be an *Accident* or Adjunct to that Thing, or belong to it only accidentally, as the Cloaths a Man hath on, the Money in his Purſe, &c. Theſe indeed are more properly called *Adjuncts*; and by the School-men are diſtinguiſhed by the Name of *Verbal Accidents*.

2. In Contradiſtinction to the *Eſſential Properties* of any Subject, many Qualities are called *Accidents*; becauſe they are there not *eſſentially*, but *accidentally*. This in the Schools is called *Accidens prædicabilis*, and implies a *Common Quality*, which may or may not be in any Subject, as any particular Colour, &c.

3. In Oppoſition to *Subſtance*, a Thing is called an *Accident*, when it is its Eſſence or Nature to *inhere* or ſubſiſt in ſome Subſtance, and cannot be alone: And thus it is with all Qualities whatſoever. This is called *Accidens prædicamentale*, and the nine laſt *Prædicaments* are in this Senſe *Accidents*.

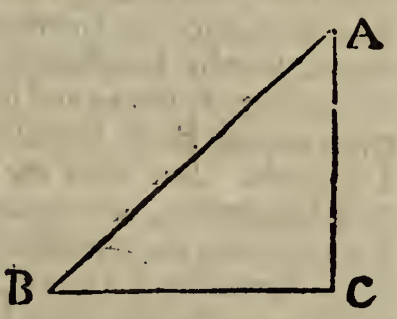
In reference to its *Cauſe* alſo, or at leaſt as to our Knowledge of it, a Thing is frequently ſtiled an *Accident*, by which we mean an Effect either caſually produced, or which to us appears to have been ſo.

ACCIDENTS, *in Heraldry*, are the *Points* and *Abatements* in an Eſcutcheon; which ſee.

ACCIDENTAL *Dignities* and *Debilities*, [*Aſtrology*] are certain caſual Affections or Diſpoſitions of the Planets, by which they are ſtrengthened or weakened on account of their being in ſuch a Houſe of a Figure.

ACCIDENTAL *Point*, in *Perſpective*, is a Point in the *Horizontal Line*, where Lines parallel among themſelves, though not perpendicular to the Picture, do meet.

ACCLIVITY is a Steepneſs reckoned upwards on a Slope Line, as *Declivis* is a Steepneſs downwards. Thus *B A* is an *Acclivity*; *A B* a *Declivity*.



ACCOMMODATE, ſignifies amongſt Geometers, to fit in a Line or Figure into a Circle, &c. ſo as the Conditions of the Propoſition or Problem require. See *Apply*.

ACCOMPANIMENTS, *in Heraldry*, are all thoſe Things that are applied about a Shield by way of Ornament, as the Belt, Mantlings, Supporters, &c.

ACCOMPT, a Writ in Law ſo called, lying againſt a Bailiff or Receiver, who will not give up his Accounts, or come to an Account for what he hath received. If the Auditors aſſigned him find that he is in Arrears, they have Power by the Statutes of *Weſt.* 2 *C.* 10. to award him to Priſon till he have made Satisfaction: But if they will not allow him reaſonable Charges, or if they charge him with more than he hath received, any Friend of his may ſue out a Writ *Ex parte talis*, from the Chancery, directed to the Sheriff, to take out four Main-Pernors, to bring his Body before the Barons of the Exchequer on a certain Day, and to warn his Lord and Maſter to appear there at the ſame Time.

ACCORD, *in Law*, is an Agreement or Contract from one Man to another, to give him Satisfaction for ſome Treſpaſs or Damage done, which when executed and performed, is a good Bar in Law againſt an Action of Treſpaſs for that Damage or Offence.

ACCORD, according to the Modern *(French)* Account of Muſick, is the Production, Mixture, and Relation of two Sounds; of which the one is *Grave*, and the other *Acute*. They make two Kinds of *Accord*; thoſe which are pleaſant and agreeable, and which they call *Conſonances*; and ſuch as are harſh and unpleaſant, which are called *Diſſonances*.

ACCRETION, nearly of the ſame Senſe with *Augmentation*, and is properly an Addition of Matter to any Body externally: This is uſually ſaid of the Increaſe of Bodies without Life, and is ſometimes called *Appoſition* or *Juxta Poſition*. But ſome will have the Increaſe of living Bodies to be by *Introſumption* and *Aſſimilation* of the alimentary or nouriſhing Particles.

Dr. *Havers*, in his *Oſteologia*, gives this Account of *Accretion*, that the nutritious Particles being ſeparated by the Glandules placed every where on the Sides of the Arteries, are carried into thoſe ſmall nervous Pipes, or Interſtices of the Fibres where the Spirits move, ſo that they fall in the Way of the Spirit's Motion: Theſe Spirits he ſuppoſes to have a twofold Motion; one direct, the other rotary, or turning round their Axes. While an Animal is capable of Accretion, and the Particles of which the ſolid Parts conſiſt are not entirely united at their Extremities, but are capable of receding one from another, both end-ways and laterally; the Spirits act upon the nutritious Particles (which are of a viſcous Nature) by their rotary Motion, by which they carry them to the Sides of the Fibres and bony Strings, driving ſome againſt the Sides of their Parts, and forcing them out laterally: Others they drive into the Interſtices between the Extremities, thereby lengthening every Series of them, where they are placed and fixed; and thus the Parts of an animal Body increaſe both in Thickneſs and Longitude. But after the Particles are united at their Extremities, and no longer capable of making Room to load the nutritious Parts out of the Way of the Spirits direct Motion, then the Spirits come to act upon the nutritious Matter by that Motion, and to drive it ſo through the nervous Channels, that it has not the Liberty of ſtopping and adhering; and ſo the Accretion of the Animal ceaſes.

ACCRETION, ACCREMENT, [in *Civil Law*] a Vage or vacant Portion of Ground joined or united with Grounds held or poſſeſſed by another.

ACERB, is a Taſte between ſowre and bitter, ſuch as moſt Fruits have before they are ripe.

ACERIDES [of α *Neg.* and κηρὸς. *Gr.* Wax.] is a Plaiſter made without Wax, ſuch as that called *Emplaſtrum Norimbergenſe*.

ACETABULUM, is that Cavity in the Huckle Bone which is appointed to receive the Head of the Thigh Bone within it: Alſo certain Glandules in the *Chorion* are called *Acetabula*, concerning which ſee *Cotyledones*.

ACETUM *radicatum*, is the ſharpeſt Part of Vinegar when the Phlegm is drawn off.

ACETUM *Philoſophorum*; ſo ſome Chymiſts call that ſowre Liquor which is made by diſſolving a little Butter, or icy Oil of Antimony, in a conſiderable Quantity of Water.

ACETUM *alcaliſatum*, is diſtilled Vinegar ſaturated with ſome alkalizate Salt.

ACHAMECH, with ſome Chymiſts ſignifies the Droſs of Silver.

ACHERNER, a bright fixed Star of the firſt Magnitude, in *Eridanus*, whoſe Longitude is 10°. 31′. of ♓, Latitude 59°. 18′.

ACHILLEIS, [*Anatomy*] a Tendon formed by the Tails of ſeveral Muſcles, and tied to the *Os Calcis*, ſo called from the Action of Swiftneſs of Pace.

ACHLYS, [ἀχλὺς, *Gr.*] a Defect in the Eye, accounted one of the Kinds of *Amblyopia*.

ACHOR, [of α, *Neg.* and χεῦρος, *Space*, becauſe thoſe Eruptions have but a ſmall Vent; call it ἀχνὼρ, of ἄχνη, any light and ſoft thing.] is a ſort of cruſted Scab which makes an Itching and Stink on the Surface of the Head, and is occaſioned by a ſerous, ſalt and ſharp Matter: The Difference betwixt an *Achor* and *Favus* conſiſts in this, that in *Achors* the Holes or Cavities are ſmall, and ſometimes not viſible; but in a *Favus* they are more large and conſpicuous.

ACHRONICAL, is uſed in Aſtronomy for the Riſing of a Star when the Sun ſets, or the Setting of a Star when the Sun riſes; in which Caſes the Star is ſaid either to riſe or ſet Achronically; which is one of the three *Poetical Riſings* or *Settings*.

ACIDITY, [*Aciditas*, *L.*] is the Taſte which Bodies that are acid or ſharp affect the Mouth with: And thoſe Bodies are called

ACIDS, whoſe Particles are ſuppoſed to be longiſh, flexible, penetrating, and attenuating; and which have their Points ſharp and piercing. And theſe are either *natural Acids*, which have a proper Acidity of their own, without the Help of Art, as Juice of Lemons, &c. or elſe *artificial Acids*, which are made by Fire in Chymical Operations. So that *acid Spirits*, or *Stygian Liquors*, as the Chymiſts call them, from their Powers to deſtroy or diſſolve Bodies, ſeem to be nothing but an acid Salt diſſolved, and put into a violent Motion by the Fire: Theſe are called *acid Menſtruums*. You may eaſily know whether any Liquor contains in it any *acid* Salt or not, by dropping ſome of it on a little Syrup of Violets ſpread on white Paper; or in a Solution of Blue-bottle Flowers, &c. for then the Blue will be immediately turned into a Red or reddiſh purple Colour; whereas if it turns green, it is a Sign the Liquor abounds with Salts of an urinous or lixiviate Nature; which how to diſtinguiſh, *ſee thoſe Words*. The Acidity of any Liquor may alſo be concluded by its being able to deſtroy the Blueneſs of a Tincture of *Lignum Nephriticum*: See *Colours*, and the Ways of producing ſudden Changes of them.

ACIDULÆ, any Medicinal Waters that are not hot, like thoſe at the *Bath*, which are called *Thermæ*.

ACINESIA, [Ἀκινησία, *Gr.*] an Immoveableneſs of the whole Body, or any Part of it, as in an Apoplexy, Palſy, &c.

ACINUS, [Ἄκινος, *Gr.*] in *Botanicks*, doth not ſignify a Grape-ſtone, but the Fruit itſelf of all ſuch Plants which bear it, in a Manner reſembling Grapes: It is ſofter and more juicy than a Berry, and therefore diſtinguiſhable from it; as it is alſo becauſe the *Acini* grow in Bunches or Cluſters, and Berries often ſingle.

ACINIFORMIS *Tunica*, is the ſame with the *Uvea Tunica* of the Eye.

ACMASTICK, [Ἀκμαστικὰ, *Gr.*] *Fever*, with ſome, is the ſame as *Synochus*.

ACME, [Ἀκμὴ, *Gr.*] in general ſignifies the Height or Top of any Thing; the Word is more eſpecially uſed to denote the Height of a Diſtemper,

ſtemper, many of which have four Periods. 1. The *Arche*, or Beginning. 2. The *Anabaſis*, or Growth and Increaſe. 3. The *Acme*, when the morbifick Matter is at the Height. 4. The *Parachme*, or the Declenſion of the Diſtemper.

ACONTIAS, [Ἀκόντιας, *Gr.*] a ſort of Comet, ſhaped like a Dart or Javelin. Its Head is ſometimes round, and ſometimes oblong or compreſſed; and its Tail or Train is ſlender, but extended to a great Length.

ACOPICA, Ἄκοπικα, of ἀ *Priv*, and κόπος, *Gr. Labour.*] Ingredients in Medicines to relieve Wearineſs.

ACOPUM, [Ἄκοπον, *Gr.*] according to ſome Writers, is a Fomentation of warm and emollient Things, to allay the Senſe of Wearineſs, occaſioned by too violent Labour or Exerciſe.

ACOR, *in Medicine*, a Sourneſs at the Stomach, proceeding from Indigeſtion, whence proceed Flatulencies and ſour Belchings.

ACOSMY, [Ἀκοσμία, *Gr.*] is an ill State of Health, accompanied with the Loſs of the natural florid Colour of the Face.

ACOUSTICKS, [Ἀκουστικὰ, of ἀκούω, *Gr. to hear.*] are Medicines or Inſtruments which help the Hearing; as to the latter of which, the Uſe of *Otacouſtick* Trumpets is now very common; and no Queſtion, Inſtruments of this Kind are capable of Improvement. Dr. *Hook*, in his Preface to his *Micrography*, ſaith, 'tis not impoſſible to hear a Whiſper a Furlong, or one eighth Part of a Mile's Diſtance; that he knows a Way by which 'tis eaſy to hear any one ſpeak through a Wall of a Yard thick; and that by Help of a diſtended Wire, the Sound may be propagated to a very conſiderable Diſtance almoſt in an Inſtant.

ACQUIETANDIS *Plegiis*, is a *Juſticies*, that lies for a Surety againſt a Creditor, that refuſeth to acquit him after the Debt is paid.

ACQUIETANTIA *de Shiris & Hundredis*, to be free from Suit and Service in Shires and Hundreds.

ACQUIETARE, *in Law*, to pay the Debts of deceaſed Perſons.

ACQUITTAL, *in Law*, ſignifies the Diſcharge of a Tenant from any Entries or Moleſtations, for any Manner of Service iſſuing out of the Lands to any Lord; that is, above the Meſne. It ſignifies alſo, when two are indicted of Felony, the one as Principal, the other as Acceſſory; the Principal being diſcharged, the Acceſſory by Conſequence is alſo acquitted.

ACQUITTANCE, ſignifieth a Releaſe or Diſcharge in Writing of a Sum of Money, or other Duty, which ought to be paid or done.

ACRASY, [Ἀκρασία, of ἀ *Neg.* and κρᾶσις, *Diſpoſition*, *Gr.*] is the Exceſs or Predominancy of one Quality above another, in the Conſtitution of a human Body.

ACRE of Land; its Quantity is four ſquare Roods, or 160 ſquare Poles, or 4840 ſquare Yards, or 43560 ſquare Feet. By a Statute of 31 of *Eliz.* 'tis ordained, that if any Man erect a new Cottage, he ſhall add four Acres of Land to it.

ACRIMONIOUS *Bodies*, are thoſe, in the general, whoſe Particles do eat, fret, deſtroy and diſſolve what comes in their Way, or which have a great *Acrimony*.

ACRIMONY, [Ἀκριμονία, *Gr.*] Sharpneſs, Tartneſs.

ACRISY, [Ἀκρισία, of ἀ *Neg.* and κρίσις, *Gr.*] is ſuch a State or Condition of a Diſeaſe, that no right Judgment can be made of the Patient whether he will recover or not.

ACROMION, [Ἀκρώμιον, of ἄκρον, the extreme Part, and ὦμος, *Gr. a Shade.*] is the upper Proceſs of the Shoulder Blade, or the Top of the Shoulder, where the Neck Bones are joined with the Shoulder Blades.

ACROMPHALUM, [Ἀκρομφάλον, of ἄκρον and ὀμφαλος, *Gr.*] is the Middle of the Navel.

ACRONICAL, ſee *Achronical.*

ACRONYCHAL, is the ſame with *Achronical*, which ſee.

ACROS, [Ἄκρος, *Gr.*] with ſome Writers is the Height of a Diſeaſe; and with ſome Anatomiſts, the Tops or Prominences of Bones, *&c.*

ACROSPIRE, the ſame with *Plume*, which ſee.

ACROSTICKS, are a certain Number of Verſes, whoſe initial Letters make up ſome Perſon's Name, Title, or ſome particular Motto.

ACROTERIA, } *in Architecture,*] little Pe-
ACROTERES, } deſtals, commonly without Baſes, placed at the Middle and both Extremes of Frontiſpieces or Pediments, which ſerve to ſupport Statues: Alſo thoſe ſharp Pinnacles, or ſpiry Battlements, ſtanding in Ranges about flat Buildings with Rails and Balluſters: Alſo the Figures, whether of Stone or Metal, that are placed as Ornaments or Crownings on the Tops of Temples, and other Edifices.

ACROTERIASMUS, [Ἀκρωτήρια, *Gr.*] the Amputation or cutting off any of the extreme Parts.

ACTINOBOLISM, [Ἀκτινοβολισμὸς, *Gr.*] is the ſame with the Diffuſion or Diradiation of Light or Sound, by which it is carried or flows every Way from its Centre.

ACTION *of a Writ*, is a Phraſe of Speech, when one pleads ſome Matter, by which he ſhews, that the Plaintiff had no Cauſe to have the Writ which he brought; and yet it may be that he may have another *Writ* or *Action* for the ſame Matter.

ACTION *upon the Caſe*, is a *Writ* brought againſt one for an Offence done without Force, as for not performing Promiſe made by the Defendant to the Plaintiff, or for ſpeaking of Words whereby the Plaintiff is defamed, or for other Miſdemeanor or Deceit, *&c.*

ACTION *mix'd*, is when it is Part *Real*, and Part *Perſonal*; and alſo is a Suit given by the Law to recover the Thing demanded, and Damages for the Wrong done.

ACTION *upon the Statute*, is a *Writ* founded upon any Statute, whereby any Action is given to one in any Caſe whereby no Action was before.

ACTIONS *Perſonal*, are Actions whereby a Man claims Debt, or other Goods or Chattels, or Damage for them, or for Wrong done to his Perſon.

ACTION *Popular*, is an Action upon the Breach of ſome Penal Statute, which any Man that will may ſue for himſelf and the King, by Information, or otherwiſe.

ACTIONS *Real*, are Actions whereby the Plaintiff claims Title to Lands, Tenements, Rents, or Commons, in Fee, or for Term of Life.

ACTION *Civil*, is that which tends only to the Recovery of what is due to any one by Contract, *&c.* as if a Man ſeek by Action to recover a Sum of Money formerly lent.

ACTION *Penal*, is that which aims at ſome Penalty or Puniſhment to the Party ſued, whether corporal or pecuniary ; as in the *Action Legis Aquiliæ* in the Civil Law, and in the Common Law in caſe of Appeals for Murder.

ACTION *Prejudicial* or *Preparatory*, is that which grows from ſome Doubt in the *Principal* ; as ſuppoſe a Man ſue a younger Brother for Land deſcended from his Father, and 'tis objected that he is a Baſtard, the Baſtard muſt be firſt tried ; that is call'd *Actio præjudicalis*, becauſe it muſt be firſt judg'd or determin'd.

ACTION *Aunceſtrel*, is in Oppoſition to Perſonal, being that which a Man hath by ſome Right deſcending from his Anceſtors : This is either *Droiturel* or *Poſſeſſory*. See *Co.* 2. *Inſtit. f.* 291.

ACTIVE *Principles*, according to the Chymiſts, are the Spirit, Oil, and Salt, becauſe their Parts being briskly in Motion, do cauſe Action on other Bodies.

ACTOR, the Doer of any thing ; alſo one who acts a Part in a *Drama* or Play. It is ſometimes uſed for a Proctor or Advocate in Civil Courts or Cauſes. *Actor dominicus* was alſo the Term formerly uſed for the Lord's Bailey or Attorney. *Actor Eccleſiæ* was ſometimes the foreign Term for the Advocate or Pleading Patron of a Church. *Actor Villæ* was the Steward or Head Bailiff of a Town or Village.

ACTUARY, the Clerk that regiſters the Acts and Conſtitutions of a Convocation.

ACUTE *Angles* : See *Angles*.

ACUTE *Angled Triangle* : See *Triangle*.

ACUTE DISEASE, is that which is over in a little Time, but not without eminent Danger to the Patient.

ACUTE ACCENT, *in Grammar*, ſhews when the Voice is to be raiſed, and is expreſſed thus (´).

ACUTE *Angular Section of a Cone*, was the Term that the ancient Geometers uſed for the *Ellipſis* ; but *Apollonius Pergæus* firſt demonſtrated, that the Section of any Cone through both its Sides, will produce the ſame Figure ; whereas they conſider'd it only in that Cone whoſe Section by the Axis is a Triangle acute angled at the Vertex.

ADARIDGE, with ſome Chymiſts, ſignifies *Sal Armoniack*.

ADDICTIO *in Diem*, in the *Civil Law*, is an Agreement between Buyer and Seller, that the Seller may contract with any other Perſon who will offer a better Price before a certain Day.

ADDITAMENTS, [*Additamenta*, *L.*] Things added a-new to the ordinary Ingredients of any Compoſition ; or to a Menſtruum, to enable it the better to open and diſſolve any Body.

ADDITION, in general, is the putting of two Things or Quantities together ; and that Quantity which ariſes or reſults from thence, is called the *Sum* or *Aggregate* of thoſe Quantities.

ADDITION in *Algebra* may eaſily be performed, by obſerving the following Rules.

Rule 1. When the Quantities given to be added into one Sum are all poſitive, or all negative, and if thoſe ſeveral Quantities be repreſented by the ſame Letter or Letters.

Add the Co-efficients (or Figures on the Left Hand of the Letters) and annex the common Sign, and the common Letters.

Thus, If x a be ſuppoſed = 12 Crowns,

Then 8 times a will be equal 96
And 7 times a will be = 84
And 10 times a will be = 120
And 12 times a will be = 144

$$\text{Add}\left\{\begin{array}{rrcr} \text{Then} + & a & = & 12 \\ + & 8\,a & = & 96 \\ + & 7\,a & = & 84 \\ + & 10\,a & = & 120 \\ + & 12\,a & = & 144 \\ \hline \text{Sum} + & 38\,a & = & 2186 \end{array}\right.$$

Then to find the Sum of the ſeveral given Products of a, firſt add the ſeveral Co-efficients of a, which are 12, 10, 7, 8, 1, their Sum is 38 ; to which prefix the common Letter a, and the common Sign +, ſo that the Sum of the whole is $+ 38\,a = 2186$.

Example 2.

$$\begin{array}{rrcr} & & & l. \\ - & a\,b & = & -40 \\ - & 5\,a\,b & = & -200 \\ - & 12\,a\,b & = & -480 \\ - & 2\,a\,b & = & -80 \\ \hline - & 20\,a\,b & = & -800 \end{array}$$

In the ſecond Example, where $-\,a\,b$ is ſuppoſed equal --- to 40 *l.* the Sum of the ſeveral Co-efficients of $-\,a\,b$ are 20, to which joyning the common Letters $a\,b$, and the common Sign, $-$ the Sum is $-\,20\,a\,b = -\,800$. After the ſame Manner the third and fourth Examples are added.

Example 3.

$$\begin{array}{rl} + & 12\,2\,y\,z \\ + & 19\,x\,y\,z \\ + & 13\,x\,y\,z \\ + & 15\,x\,y\,z \\ + & 17\,x\,y\,z \\ \hline + & 76\,x\,y\,z \end{array}$$

Example 4.

$$\begin{array}{rl} - & c\,d\,x \\ - & 5\,c\,d\,x \\ - & 12\,c\,d\,x \\ - & 19\,c\,d\,x \\ - & 15\,c\,d\,x \\ \hline - & 52\,c\,d\,x \end{array}$$

The Reaſon of this Rule is evident, for in Example 1, where a is ſuppoſed to be equal to 12 Crowns, if it be added to 8 times a, which is $8\,a = 96$ Crowns, the Co-efficient 1, which repreſents a taken once, and the Co-efficient 8, which repreſents a taken 8 times, the Sum of theſe Co-efficients, *viz.* $8 + 1 = 9$ joined to a, repreſents a taken 9 times, which is $= 108$, equal to $96 + 12 = 8\,a + a$ the Quantities given to be added. After this Method any Number of Co-efficients (when the Quantities are all repreſented by the ſame Letters, and have the ſame Signs) being ſummed up, and the common Letter or Letters joined with that Sum, and the common Sign annexed, will be the Sum required ; as in Example 2. and 4. where the Signs are all negative, the Sum of the Co-efficients will be the Number of times the Quantity is taken, only the Sum muſt be negative, becauſe all its Parts are negative ; but in thoſe Examples where all the Signs are poſitive, the Sum will be poſitive.

Rule 2. When the Quantities given to be added are all repreſented by the ſame Letters, but have unlike Signs.

Sum up all the poſitive Quantities (as in *Rule* 1.) alſo find the Sum of all the negative Quantities (by *Rule* 1.) then if the Co-efficient of the negative Quantity be leſs than the Co-efficient of the poſitive, ſubtract the Co-efficient of the negative Quantity from the Co-efficient of the Poſitive, and to the Remainder join the common Letter or Letters with the Sign $+$ will be the Sum required; but if the Co-efficient of the poſitive Sum be leſs than the Co-efficient of the negative, ſubtract the poſitive from the negative, and to the Remainder prefix the common Letter or Letters with the Sign $-$ which will be the Sum required; and if the Co-efficients of the poſitive and negative Quantities given to be added be equal, their Sum will be nothing. Thus:

Example 1.

$$\begin{array}{lr} & l. \\ \text{Add}\left\{\begin{array}{l}\text{Let } +ab = \\ \phantom{\text{Let }} -ab = \end{array}\right. & \begin{array}{r}48\\48\end{array} \\ \hline & \text{their Sum is } 0 \end{array}$$

Example 2.

$$\begin{array}{l} \text{Add}\left\{\begin{array}{l} -15ab \;-\; 30 \\ +10ab = +20 \end{array}\right. \\ \hline \text{Sum } -5ab = -10 \end{array}$$

In *Example* 1. $+ab$ is equal to Affirmative 48 *l.* and $-ab$ equal to Negative 48 *l.* therefore Negatives deſtroys the Affirmatives being added to them. Alſo in *Example* 2. $-15ab$ being added to $+10ab$: $-10ab$ deſtroys $+10ab$, and $-5ab$ remains for the Sum. Alſo in the following *Examples*, the Negatives deſtroy an equal Number of the Poſitives, and the Difference between the Poſitives and Negatives is the Sum required with the Sign of the greateſt Quantity.

Example 3.

$$\begin{array}{l} \text{Add}\left\{\begin{array}{l} +17xyz = +1700 \\ -8xyz = -800 \end{array}\right. \\ \hline \text{Sum } +9xyz = +900 \end{array}$$

Example 4.

$$\begin{array}{l} \text{Add}\left\{\begin{array}{l} +24cdy = +2400 \\ -12cdy = -1200 \end{array}\right. \\ \hline \text{Sum } +12cdy = +1200 \end{array}$$

Example 5.

$$\begin{array}{lrcr} & +6xy & = & +60 \\ & -7xy & = & -70 \\ & +10xy & = & +100 \\ & -3xy & = & +30 \\ \hline \text{Sum of the Poſ.} & +16xy & = & +160 \\ \text{Sum of the Neg.} & -10xy & = & -100 \\ \text{Sum required.} & +6xy & = & +60 \end{array}$$

Example 6.

$$\begin{array}{lrcr} & -24ab & = & -48 \\ & +12abc & = & +24 \\ & +20abc & = & +40 \\ & -60abc & = & -120 \\ & -30abc & = & -60 \\ \hline \text{Sum Neg.} & -114abc & = & -228 \\ \text{Sum Poſit.} & +132abc & = & +64 \\ \hline \text{Sum required.} & -82abc & = & -164 \end{array}$$

That to add a Negative to an Affirmative, is the ſame as to ſubtract a Poſitive from a Poſitive, appears from the Definition of poſitive and negative Quantities, and in the Affairs of Life may be prov'd thus: Suppoſe a Man worth 1000 *l.* real or poſitive Eſtate, but by being Surety for his Friend, a Debt of 200 *l.* is charged to his Accompt, that 200 *l.* is negative Eſtate, and being added to his poſitive Eſtate, deſtroys 200 *l.* of it, which is the ſame as if he had ſubtracted 200 *l.* of poſitive Eſtate; therefore to add a Negative to an Affirmative, is the ſame as to ſubtract an Affirmative from an Affirmative; conſequently when a Negative is given to be added to an Affirmative, the Co-efficient of the Negative muſt be ſubtracted from the Co-efficient of the Affirmative, and the Remainder is the Sum, and is a poſitive Quantity, as in *Example* 3. and 4.

But when the negative Co-efficient is greater than the poſitive, to which it is given to be added; in that Caſe the Co-efficient of the affirmative Quantity is to be ſubtracted from the Co-efficient of the negative Quantity, and the Remainder is the Sum; but negative, becauſe the Negative exceeding the Poſive, after having deſtroyed all the Poſitives; there remains a Number of Negatives equal to thoſe that the Negatives exceeded the Poſitives.

Again, that to add a Poſitive to a Negative is the ſame as to ſubtract a Negative from a Negative, appears alſo from the Definition of poſitive and negative Quantities, and in the Affairs of Life is thus: Suppoſe a Man to owe a 1000 *l.* more than his affirmative Eſtate is worth, if his Friend pay 500 *l.* of the Debt, it is adding a poſitive to his negative Eſtate, which deſtroys 500 *l.* of the Negative; therefore when a poſitive Quantity is given to be added to a negative, ſubtract the Co-efficient of the poſitive from that of the negative, and the Remainder will be the Sum and a negative Quantity; but if the poſitive have the greateſt Co-efficient, ſubtract the negative Co-efficient, and the Remainder will be the Sum and will be affirmative.

Rule 3. When the Quantities given to be added are unlike, (that is when they are repreſented by different Letters) whether they have the ſame or different Signs; ſet them down one after another with their reſpective Signs, thus;

Example 1.

$$\begin{array}{l} \text{Add}\left\{\begin{array}{l} +7xy = +45 \text{ Horſes.} \\ -5xb = -20 \text{ Men.} \\ +7dc = +12 \text{ Oxen.} \\ -14ab = -30 \text{ Crowns.} = \text{Ho.M.Ox.Cr.} \end{array}\right. \\ \hline \text{Sum } 7xy - 5xb + 7dc - 14ab = 45 - 20 + 12 - 30 \end{array}$$

Example 2.

$$\begin{array}{l} \text{Add}\left\{\begin{array}{l} +5xz = 10\,l. \\ +4ab = 19\,s. \\ -cd = -10\,d. \\ -ay = -2\,f. \qquad l. \quad s. \quad d. \quad f. \end{array}\right. \\ \hline \text{Sum } +5xz + 4ab - cd - ay = 10 + 19 - 10 - 2 \end{array}$$

Corollary. The Addition of unlike Quantities produceth compound Quantities, which may be added as in the following Rule.

Becauſe different Letters repreſent different Kinds of Quantities, they cannot be added together any other Way than by placing them one after another; for if 6 *a* be added to 5 *b*, and *a* repreſent 600 Men, and 5 *b* repreſent 500 Horſes; and if the Sum of both were required, it is evident that their Sum will be $6a + 5b$, that is 600 Men, and 500 Horſes; therefore the Addition of all unlike Quantities may be performed by placing them one after another with their given Signs.

Rule 4. When the Quantities given to be added are compound Quantities, that is, when they are joined with + or −.

Add thoſe Quantities that are repreſented by the ſame Letters, and have the ſame Signs, by *Rule* 1. alſo thoſe Quantities that are like and have unlike Signs, add by *Rule* 2. and unlike Quantities you are to add by *Rule* 3. and thoſe Sums joined together with their reſpective Signs is the Sum required.

Example 1.

$$\begin{array}{rl} \text{Add} & \left\{\begin{array}{l} +5ab - 17xy + 10cd \\ +6ab - 19xy + 5cd \end{array}\right. \\ \hline \text{Sum} & 11ab - 36xy + 15cd \end{array}$$

Example 2.

$$\begin{array}{rl} \text{Add} & \left\{\begin{array}{l} aa - 5a + 24 \\ aa + a - 17 \\ -2aa + 2a + 12 \end{array}\right. \\ \hline \text{Sum} & 0 - 2a + 19 \end{array}$$

Example 3.

$$\begin{array}{rl} \text{Add} & \left\{\begin{array}{l} x + b \\ c - e \\ y + x \\ b - z + y \end{array}\right. \\ \hline \text{Sum} & 2x + 2y + 2b + c - e - z \end{array}$$

Example 4.

$$\begin{array}{rl} \text{Add} & \left\{\begin{array}{l} 5xxx - 3yy + 10 \\ 4xxx + 2yy + 12a \\ 10xxx + 10zz + 10b \\ -12xxx + 10yy - 10c \end{array}\right. \\ \hline \text{Sum} & 7xxx + 9yy + 10zz + 10 + 12a + 10b - 10c \end{array}$$

which is the Sum by the preceeding Rules.

In Addition of compound Quantities, thoſe of the ſame Kind, that is, that are repreſented by the ſame Letters, are to be added as ſimple Quantities, if they have like Signs by (*Caſe* 1.) if unlike Signs by (*Rule* 2.) and thoſe Quantities that are unlike, or repreſented by different Letters, are added by (*Rule* 3.) Then all theſe ſet down one after another with their reſpective Signs, is the Sum of the given Quantities, and the Reaſons for the preceeding Rule make this Rule very evident.

ADDITION, is the Term in our common Law for the Title which is given to any Perſon beſides his Chriſtian and Surname, in order to diſtinguiſh him by his Degree, Eſtate, Myſtery, Trade, Place of Abode, &c.

And 'tis particularly proved by the *Stat.* 1 *H.* 5. *c.* 5. that in Suit of Action where Proceſs of Utlars lies, ſuch Additions ſhall be given to the Name of the Defendant; and that Writs not having ſuch Additions ſhall *abate*, if the Defendant take Exceptions thereunto.

ADDITION of *Integers*, in common Arithmetick, is performed by this ſingle Rule:

Set the Numbers orderly one under another, *i. e.* Units under Units, Tens under Tens, Hundreds under Hundreds, &c.

Then collect each Column ſingly into one Sum, beginning at the Right Hand, at the Place of Units; and if the Units in that Row are leſs than 10, ſet them down under the Line, but if they are more than 10, ſet down only the Overplus, and carry the Tens to the next Row, in which ſet down (under the Line) the odd Tens, and carry the Hundreds to the third Column, &c. as you will ſee in the following Examples.

$$\begin{array}{r}16\\72\\\hline 88\end{array}\qquad\begin{array}{r}34\\68\\\hline 102\end{array}\qquad\begin{array}{r}756\\382\\568\\\hline 1706\end{array}\qquad\begin{array}{r}5789\\3452\\7898\\3257\\\hline 20396\end{array}\qquad\begin{array}{r}93256\\13700\\78250\\97662\\15628\\\hline 298496\end{array}$$

But if the Numbers be of different, or of ſeveral Denominations, then they muſt be added by ſumming up each Denomination by it ſelf, and ſeeing how many of them will make one of the next Denomination; and bearing ſo many Units forwards as thoſe will come to.

Thus, ſuppoſe the following Pounds, Shillings, and Pence, were to be collected into one Sum.

l.	*s.*	*d.*
135 :	17 :	08
95 :	11 :	02
3 :	05 :	09
234 :	14 :	07

Beginning with the Pence, I ſay 9 and 2 are 11, and 8 makes 19, which becauſe it is 7 above 12, or a Shilling, I ſet down the odd Seven Pence, and carry one Shilling to the next Rank. Say 1 that I carry and 5 is 6, and 1 is 7, and 7 is 14; I ſet down 4, and I find I have in all 3 Tens, therefore I ſet down one Ten on the Left Hand of the 4, and carry one Pound to the Column of Pounds; where I proceed, juſt as in *Addition of Integers*, and find the whole Sum to be 234 *l.* 14 *s.* 07 *d.*

ADDITION *of Logarithms*: See *Logarithms*, N° 3.

ADDITION *of Vulgar Fractions*: See *Vulgar Fractions.*

ADDITION *of Decimal Fractions*: See *Decimal Fractions.*

ADDUCENT MUSCLES, are thoſe that bring forward, cloſe, or draw together the Parts of the Body whereunto they are annexed.

ADDUCTORES, the ſame with *Adducent Muſcles.*

ADDUCTOR OCULI, is a Muſcle of the Eye, ſo call'd, becauſe it inclines its Pupil towards the Noſe; and alſo *Bibitorius*, it directing the Eye towards the Cup in drinking.

ADDUCTOR *Pollicis*, is a Muſcle of the Thumb, which ariſes tendinous in common with the *Abductor Indicis*, and becoming fleſhly, aſcends obliquely to its broad Termination at the ſuperior Part of the firſt Bone of the Thumb. This brings the Thumb nearer the Fore-finger.

ADDUCTOR *Pollicis Pedis*, is a Muſcle of the Great Toe, which ariſeth partly tendinous and partly fleſhy from the inferior Parts of the *Os cuneiforme tertium*, and dilating its ſelf to a fleſhy Belly, marcheth obliquely in the Bottom of the Foot, and becomes leſs and tendinous at its Inſertion to the internal Part of the *Oſſa Seſſamoidea* of the Great Toe, laterally oppoſite to the Termination of the *Abductor Pollicis Pedis.* This brings the Great Toe nearer the reſt.

ADEN, [Ἀδὴν, *Gr.*] is the Term for a Glandule in an animal Body, which is either conglobated, as the Glands of the *Meſentery*, &c. With ſome 'tis alſo uſed for a Tumour in the Groin, the ſame with *Bubo.*

ADENOGRAPHY, [of Ἀδὴν and γράφω, *Gr.* *I write,*] a Treatiſe or Deſcription of the Glands.

ADENOSUS *Abſceſſus*, [*Surgery*] a hard unripe Tumour or Swelling, which proceeds from obſtructed Viſcidities; it has the Appearance of a natural Gland, although in Parts free from them.

ADEPS, or *Pinguedo*, *Fat*, is a ſimilar Part of the Body: But *Adeps* and *Pinguedo* differ in this, that *Adeps* is a thicker, harder, and more earthy Subſtance than *Pinguedo*; the Fat which is particularly meant by *Adeps*, flows from the Blood thro' peculiar Veſſels into Bags or Bladders appropriate thereunto, as is plain from the Obſervation of *Malpighius*.

ADEPTISTS, or *Adepts*, [of *Adipiſcor*, *L. to get or obtain*,] are ſuch Alchymiſts as pretend to have gained the Secret of the *Tranſmutation of Metals*, or to make the *Philoſopher*'s Stone: Of theſe myſtical inviſible Gentlemen, they ſay, there are 12 always in being, which are kept ſupplied by new ones when any one of the Fraternity pleaſeth to die, or to tranſlate himſelf to ſome Place where he can make uſe of his Gold; for in this wicked World it will not procure them Shirts.

ADEQUATE, [*Adæquatus*, *L.*] a thing is ſaid to be adequate to, or adequately to agree with another, when 'tis every Way equal to it in Extent, Capacity, Power, *&c.* and all other Properties; and neither exceeds it, nor falls ſhort of it in any Reſpect. And thus when the Notions or Ideas that we have of any thing, take in all the Properties of that Thing, and that we omit conceiving nothing which belongs to it, we then ſay we have *adequate Ideas* of ſuch things.

ADEQUATE IDEAS, are thoſe Ideas which perfectly repreſent the Architypes or Images which the Mind ſuppoſes them to be taken from; which it intends them to ſtand for, and to which it refers them.

ADHESION, [*Adhæſio*, *L.*] a cleaving or ſticking to.

ADHESION, *in Natural Philoſophy*, ſignifies the State of two Bodies which are joined or faſtened together, either by the mutual Interpoſition of their own Parts, or the Compreſſion of external Bodies.

ADJACENT, or *Contiguous Angles*, ſee *Angles*.

ADIAPHORUS, or *Neutral*, *i. e.* indifferent, [of α *Priv.* and διάφορος, *Gr.*] So Mr. *Boyle* calls a kind of Spirit, which he diſtilled from *Tartar* and ſome other vegetable Bodies, which was neither *acid*, *vinous*, nor *urinous*. 'Tis made thus: Firſt, Shavings of Box, Guajacum, or any other ponderous Wood, are diſtilled *per ſe* in a Retort; and then the ſouriſh Liquor is rectified to free it from the Phlegm: After this a Quantity of Powder of Coral, *&c.* was thrown into the ſour Spirit, which it readily diſſolved, and the acid Parts of the Menſtruum did ſo aſſociate themſelves with the Coral, as to leave a Part of Liquor that was by no Means of an acid Nature, but which when gently drawn off the Coral, was of a ſtrong Smell, yet without any Acidity, and in many Reſpects of a different Nature from almoſt any other common Spirit.

ADJECTIVES, *in Grammar*, are ſuch Words as deſcribe the Manner only of the Being of a thing, and have no natural Subſiſtence of their own, but do ſubſiſt by Noun Subſtantives, to which they are joined.

AD INQUIRENDUM, a Writ in Law commanding an Enquiry to be made (for the better Execution of Juſtice) about the Merits of a Cauſe depending in the King's Court.

ADJOYNING *Angles*, in *Geometry*: See *Angles*, or *Contiguous*.

ADJOURNMENT, is the putting off of any Court or Meeting, and appointing it to be kept at another Place or Time.

ADIPOSA MEMBRANA, is the Baſis of the *Cellulæ adipoſæ*, it is double, and may be divided into two Parts; the one is external, throughout which there are a Number of little Cells full of Fat; the other is internal, which Anatomiſts have miſtaken for the *Membrana carnoſa*, becauſe it has a greater Number of Blood Veſſels.

ADIPOSA VENA, or *Renalis*, a Vein ariſing from the deſcending Trunk of the *Cava*, which ſpreads its ſelf on the Coat and Fat that covers the Kidneys.

ADIPOSI DUCTUS, call'd alſo *Sacculi*, *Veſiculæ adipoſæ*, or *Lobuli*, are Veſſels which convey the *Adeps* or Fat into the Interſtices of the Muſcles, or to the Parts between the Fleſh and the Skin.

ADIPSA, [Ἄδιψα, *Gr.*] Medicines or Juleps to quench Thirſt.

ADIT, is the Shaft, or Entrance into any Mine.

ADJUDGE, when a determinate Sentence is paſs'd in the Behalf of another, the Caſe is ſaid to be adjudged for him.

ADJUNCT: Whatever comes to any Being from without, is called an *Adjunct* to that Being; as being not naturally and eſſentially belonging to it, but adjoined or ſuperadded to it.

AD JURA REGIS, is a Writ that lies for the King's Clerk againſt him that ſought to eject him, to the Prejudice of the King's Title in Right of his Crown.

ADJUTANT, an Officer in the Army, the ſame with an *Aide-Major*; which ſee.

ADJUTORIUM, [*with Phyſicians*,] a Means of Cure ſubſervient to others of more Importance. *L.*

ADJUTORIUM, [*Anatomy*,] a Bone ſo nam'd, becauſe of its Uſefulneſs in lifting up the Arm. *L.*

ADMEASUREMENT *of Dower*, is a Writ that lies where a Woman is endowed by an Infant, or by a Guardian, of more than ſhe ought to have.

ADMEASUREMENT *of Paſture*, is a Writ that lies againſt ſuch, as having Common of Paſture appendant to their Freeholds, do ſurcharge it with more Cattle than they ought to do.

ADMINISTRATION, [*in Law*] is the diſpoſing of a Man's Goods or Eſtate that died inteſtate, or without any Will, with an Intent to give an Account thereof.

ADMINISTRATOR, he that has the Goods of a Man dying inteſtate, committed to his Charge by the Ordinary, and is accountable for the ſame. If the Perſon be a Woman, ſhe is called an *Adminiſtratrix*.

ADMITTENDO CLERICO, is a Writ granted to him that hath recovered his Right of Preſentation againſt the Biſhop in the *Common Bench*.

ADMITTENDO *in Socium*, is a Writ for the Aſſociation of certain Perſons to Juſtices of Aſſize before appointed.

ADNASCENTIA }
ADNATA } [*Botany*] thoſe Excreſcencies which grow under the Earth, as in the *Lilly*, *Narciſſus*, *Hyacinth*, &c.

ADNASCENTIA, }
ADNATA, } [*Anatomy*] Branches which ſprout out of the main Stock, as the Veins and Arteries.

ADNATA TUNICA, is the common Membrane of the Eye, called *Conjunctive*, it ſprings from the Skull, grows to the exterior Part of the *Tunica cornea*; and that the viſible Species may paſs there, leaves a round Cavity forward, to which is annexed another Tunic, without any particular Name, made up of the Tendons of thoſe Muſcles which move the Eye; by Reaſon of its Whiteneſs, 'tis called *Albuginea*.

AD OCTO, among ſome of the ancient Philoſophers, is a Term ſignifying the higheſt or ſuperlative Degree, becauſe they reckoned no Degree above the Eighth, in their Way of diſtinguiſhing of Qualities.

ADONICK, a Sort of ſhort Verſe, conſiſting of a *Dactyle* and a *Spondee*; as, *rara juventus*: 'Tis uſually placed at the End of each Stanza of Sapphick Verſes, ſo called from *Adonis*, in whoſe Praiſe they were firſt made.

ADORAT, [with *Chymiſts*,] a Weight of Four Pounds.

AD PONDUS OMNIUM, [in *Phyſicians Preſcriptions*,] ſignifies that the Ingredient or Medicine laſt preſcrib'd, muſt be of the ſame Weight as all the reſt preſcribed. *L.*

AD QUOD DAMNUM, is a Writ, which ought to be ſued before the King grant certain Liberties, as a Fair, Market, *&c.* to the Prejudice of others.

There is alſo another Writ of *Ad quod damnum*, if any one will turn a common Highway, and lay out another as beneficial.

ADRAMIRE; ſee *Arraign.*

AD TERMINUM *qui præteriit*, is a Writ of Entry, that lies where a Man having leaſed Lands or Tenements for Life or Years, and after the Term expired, is held from them by the Tenant, or other Stranger that occupieth the ſame, and deforceth the Leſſor: In ſuch Caſe this Writ lieth for the Leſſor and his Heirs.

ADVANCE *Foſſe*, is a Ditch of Water round the *Eſplanade* or *Glacis* of a Place, to prevent its being ſurpriſed by the Beſiegers: But of late this Work hath been diſuſed, becauſe as ſoon as the Enemy could drain it, it was a Trench ready made for the Advantage of the Beſiegers.

ADVANCE GUARD, is the firſt Line or Diviſion of an Army, ranged or marching in Battle-array; or that Part which is next to the Enemy, or which marches firſt towards them. The whole Body of an Army conſiſts of the *Advance Guard*, the *Arriere Guard*, and the *Main Body.*

Sometimes alſo a Party of 15 or 20 Horſe, commanded by a Lieutenant beyond, but within Sight of the *Main Guard*, is called an *Advance Guard*, and is deſigned for the greater Security of the Camp.

ADVENT, in the ſacred Kalendar, is the Time from the *Sunday* that falls either upon St. *Andrew*'s Day, or next to it, till *Chriſtmas*; which Time was wont anciently to be ſpent in a pious Preparation for the Advent, or coming on of the Feaſt of our Saviour's Nativity.

ADVENTITIA BONA, were anciently ſuch as came to a Man unexpectedly, *Windfalls*, as we call them now: Hence the Word *Adventitious* comes to be uſed by Philoſophick Writers, and to ſignify ſuch Matter as doth not properly belong to any mix'd Body, but comes to it from ſome other Place. Thus, 'tis a Queſtion, whether in the Freezing of Water, there do not enter in ſome *Frigorifick Particles*, which are *adventitious* to the Water, from the Air, or Freezing Mixture. *L.*

ADVENTITIOUS *Glandules*, [*Anatomy*,] thoſe Kernels that are ſometimes under the Armholes, in the Neck, *&c.*

AD VENTREM INSPICIENDUM, is a Writ mentioned in the Statute of Eſſoignes: See *Ventre inſpiciendo.*

ADVERB, [*in Grammar*,] is a Part of Speech undeclined, and without Conjugation; and is uſually joined with a Verb to expreſs the Manner of Action. They are diſtinguiſhed into Adverbs of *Time*, *Place*, &c.

ADULTERATION of any Thing, ſuch as Wine, Medicinal Drugs, Chymical Preparations, *&c.* is a mixing ſome baſer Matter with it, which hinders it from being truly good and genuine in its Kind.

ADUMBRATION, [*in Heraldry*,] is when any Figure in a Coat Armour is born ſo ſhadowed or obſcured, that nothing is viſible but the bare Purfill, or as it is called by Painters, the *Out-line*, when this happens, it is ſaid to be *adumbrated*.

ADVOCATE, [*Advocatus*, *L.*] a Perſon well ſkilled in the Civil Law, who maintains the Right of ſuch Perſons as need his Aſſiſtance.

ADVOCATES, in the Eccleſiaſtical Court, were either *Advocate* of the Cauſes and Intereſt of the Church, retain'd as a Counſellor and Pleader, to maintain the Properties and Rights: Or, *Advocate* or Patron of the Preſentation and Advowſon. Both theſe Offices did formerly belong to the ſame Founder of a Church or Convent, and his Heirs, who were bound to protect and defend the Church, as well as to nominate or preſent to it. But when the Patrons grew negligent, or were Men of no Intereſt or Ability in the Courts of Juſtice, then the Religious began to retain a *Law Advocate*, to ſollicite and proſecute their Controverſial Cauſes. See *Spelman.*

ADVOCATIONE *Decimarum*, is a Writ that lies for the Claim of a Fourth Part, or upward, of the Tithes belonging to any Church.

ADVOWEE, or AVOWEE, in *Latin*, *Advocatus*, was formerly us'd for him that had Right of Preſentation to a Benefice; and the *Avowee Paramount* was the higheſt Patron, or the King, by the Statute of Proviſors, 25 *E.* 3.

ADVOWSON, in our *Common Law*, ſignifies a Right to preſent a Benefice, and is as much as *Jus Patronatus* in the *Canon Law*; the Reaſon why it is termed Advowſon (*Advocatio*) is, becauſe anciently thoſe who had a Right to preſent to a Church, were Maintainers of it, or great Benefactors to it: Theſe were ſometimes called *Patroni*, and ſometimes *Advocati.* Now, in the general, an Advowſon is where a Biſhop, Dean or Chapter, and their Succeſſors, or any Lay Patron, have a Right to preſent whom they pleaſe, to any ſpiritual Benefice, when it becomes void. *Advowſon* is of two ſorts; Firſt, *Advowſon in Groſs*, that is, ſole or principal, not belonging to any Manor, as a Parcel of its Right. Secondly, *Advowſon Appendant*, which depends upon a Manor as appurtenant to it; and this may be ſold by it ſelf, and then it is in *Groſs*: And while it is dependant to the Manor, it is by *Kitchen* called an *Incident.*

ADVOWSON of a Religious Houſe; as the Builders and Endowers of a Church were the Patrons of it; ſo thoſe that founded any Religious Houſe, had the *Avowſon* or *Patronage* of it. Sometimes the Patron had the ſole Nomination of the *Prelate*, *Abbot*, or *Prior*, either by Inveſtiture, (or Delivery of a Paſtoral Staff) or by direct Preſentation to the Dioceſan. And if a free Election was left to the Dioceſan, yet a *Conge d'Eſlire*, or Licence of Election, was firſt to be obtained of the Patron; and the Perſon elected was confirmed by him. If the Founder's Family was extinct, the Patronage of the Convent went to the Lord of the Manor.

ADUST, [*Aduſtus*, *L.*] burnt or parched; the Blood is ſaid to be *aduſt*, when by Reaſon of any ex-

extraordinary Heat, the thinner Parts are ſteam'd forth, and the thicker remain dreggy and black, as if they were burnt.

ADZ, is an Inſtrument whoſe Blade is made thin and ſomewhat bending, and hath not its Edge parallel to its Handle, as the Axe and Hatchet hath, but placed athwart to it. It is ground to a Baſil on the Inſide to its outer Edge. Its general Uſe is to take off thin Chips of Timber or Boards, and ſuch Irregularities as the Axe can't come at, and where a Plane, though rank ſet, will not make Riddance enough. 'Tis much uſed in taking off the Irregularities of Floors when they are pinned and framed together; and ſometimes on Poſts framed upright, and ranged in with other Work framed to them, where the Edge of the Axe can't come.

ÆDOICA *Ulcera*, [*Surgery*,] a Swelling between the Noſe and great Corner of the Eye, which if not opened timely, the Bone underneath will putrify.

ÆGILOPS, ['Αἰγίλωψ, *Gr.*] *Angilops*, and *Anchylops*, is a Tumour or Swelling in the great Corner of the Eye by the Root of the Noſe, either with or without an Inflammation.

ÆGYPTIACUM, ſc. *Unguentum*, in *Pharmacy*, is a kind of deterſive Ointment, deſcribed by *Meſne*; and is ſo called from its black Colour, like the Hue of an *Egyptian*.

ÆIPATHIA, ['Αειπάθεια, *Gr.*] a Paſſion or Affection of long Continuance.

ÆNIGMA: See *Enigma*.

ÆOLIPYLE, is a round hollow empty Ball made of Iron, Braſs, Copper, *&c.* and furniſhed with a Neck, in which there is a very ſlender Pipe opening to the Ball. Sometimes the Neck is made to ſcrew into the Ball, which is the beſt Way, becauſe then the Cavity may the more readily be filled with Water. But if there be no Screw, you muſt fill it with Water thus: Heat the Ball red hot, and then throw it into a Veſſel of Water; the Water will run in at the ſmall Hole, and fill about two Thirds of the Cavity; and if after this the *Æolipyle* be laid on or before the Fire, ſo that the Water and Veſſel become very much heated, the vaporous Air will be forced out with a very great Noiſe and Violence; but it will be by Fits, and not with a conſtant and uniform Blaſt. Perhaps they may be ſometimes of Uſe to blow the Fire, where a very quick and ſtrong Blaſt is required; and they may ſerve to ſcent or perfume a Room, by filling them with perfum'd inſtead of common Water.

ÆQUATOR: See *Equator*.

ÆQUILATERAL: See *Equilateral*.

ÆQUILIBRIUM, is when either equal Weights at equal Diſtances, or unequal ones at reciprocally proportionable Diſtances from the Center, make the Arms of any Libra or Balance to hang even, ſo that they do equiponderate and not out-weigh one another: In ſuch a Caſe, we ſay the Balance is *in Æquilibrio*. *L.*

ÆQUIVOCAL: See *Equivocal*.

ÆRA: *Lucilus*, and ſome others ſay, that *Æra* did originally ſignify a Number ſtamp'd on Money to determine its current Value; and in this Senſe it comes from *Æs*, Braſs, from the Plural of which *Æra*, came this Feminine Singular *Æra*; and that either becauſe they put the Word *Æra* to each Particular of an Account, as we now do *item*; or elſe becauſe the Number of Years was anciently among the *Romans* mark'd down in Tables with little Braſs Nails. In reference to which latter Cuſtom, the Word *Æra* came to ſignify the ſame with *Epocha*, *viz.* a certain Time or Date from whence to begin the New Year; or ſome particular Way of reckoning Time and Years. And in this Signification the Word is thought to riſe from theſe initial Letters, *A. E. R. A.* which, among the *Spaniards*, who began their *Æra* from the Reign of *Auguſtus*, ſtood for *Annus erat Regni Auguſti*. The moſt eminent *Æra's* among Chronologers, are the *Æra* of the World's Creation, which, according to the *Julian* Account of Time, began in the Month of *October*, and on the 24th Day. Some place this 3950 Years before Chriſt's Birth, who as *Gaſſendus* ſaith, come neareſt to Truth, and that this *Æra* is confirmed by the *French Aſtronomers*; others account 3983 Years before the Birth of our Saviour, and with theſe *Petavius* joins; *Kepler* makes them 3993; and there are ſome who will have it, that the true Number is 5199.

The *Jewiſh Æra*, or Period, invented by *Hillel* about the Year of Chriſt 344. This is by no Means Hiſtorical, but Artificial and Aſtronomical, and is ſuited to the *Jews* falſe Account of the New Moons, Feaſts, Holy-days, *&c.* and is of far later Standing than the Beginning of the World, though they uſe it as the Date of the Creation; it begins in *Autumn*.

The *Æra* from the *Deſtruction of Troy*, begins *June* 16, as *Scaliger* proves out of *Ephorus*; it is very common in profane Authors.

The *Æra* of *Nabonaſſar* begins the 26th of *February*, (747 Years before Chriſt) but it varieth in 1461 Years through the whole 365 Days; for ſo many he accounts, neglecting the odd Hours, which makes a great Intercalation.

The *Æra* of the *Olympiads* begins from the New Moon in the Summer *Solſtice* 777 Years before Chriſt; and the *Æra* of *Iphitus* is only a Collection of the Olympick Years: Theſe two are the *Æra's* chiefly uſed by *Greek* Hiſtorians.

The *Roman Æra*, from the Building of the City, begins *April* 21, and is 752 Years before Chriſt.

The *Chriſtian Æra* from the Birth of Chriſt, begins *December* 25.

The *Turkiſh Æra*, or the *Hegira*, begins the 16th Day of *July*; they account it from *Mahomet's* Flight, *A. D.* 622.

The *Æra* of the Death of *Alexander* the *Great*, is the 12th of *November*, 324 Years before Chriſt: See *Epocha*.

ÆSCHYNOMENOUS PLANTS, ſuch as if touch'd by the Hand or Finger, ſhrink in or flag their Leaves, the ſame as *ſenſitive*; which ſee.

ÆSTIVAL SOLSTICE, or *Summer Solſtice*: See *Solſtice*.

ÆSTUARY, is an Arm of the Sea running up a good Way into the Land, like the *Briſtol* Channel, *&c.*

ÆSTUARY, [with *Phyſicians*,] the receiving the Vapours or Steam of certain Drugs, Herbs, *&c.* into the Body through a Hole made in a Seat or Chair.

ÆS USTUM, or calcin'd Copper, is made by ſtratifying Plates of Copper with Powder of Sulphur in a Crucible, whoſe Cover or Lid hath a Hole in it to give the Vapours Vent, while the Matter is calcining in a ſtrong Fire, till no more Fumes will ariſe; the Plates muſt lie ſeparated while hot. In this Stratification the firſt and laſt Beds or Layers muſt be of the Sulphur.

ÆTATE PROBANDA, is a Writ of Office, and it lies for the Heir of the Tenant that held of the King in chief, to prove that he is of full Age, directed to the Sheriff to enquire of his Age; and then he ſhall become Tenant to the King by the ſame Services that his Anceſtors made to the King.

ÆTHER: Dr. *Hook*'s *Microgr.* p. 13. calls the Æther that Medium or fluid Body in which all other Bodies do as it were ſwim and move. But this ſeems to me to favour the *Carteſian Doctrine* of an Abſolute *Plenum*, which, by many infallible Reaſons and Experiments, is proved to be impoſſible. As therefore we call the *Medium* in which we breathe and live, the Air, by which we underſtand an elaſtical fluid Body, either having its very large Interſtices devoid of all Matter, or elſe filled in part with a Fluid, which is very eaſily moved out of them by Compreſſion, and which readily returns into them again, when that Compreſſion is taken off: So we agree to call that finer fluid Body, if it be a Body, which is extended round our Air and Atmoſphere, above it and beyond it, up to the Planets, or to an indefinite Diſtance; this, I ſay, we call the *Æther*, though what we mean by that Word, we ſcarce well underſtand. For that there can be no Fluid whoſe Parts do reſiſt the Motions of Bodies through them (as our Air doth) in the Planetary Regions, we are certain almoſt to a Demonſtration; becauſe the Motion of the Heavenly Bodies is by no Means impeded or altered by any ſuch Reſiſtance, but they move as freely as if they were in an abſolute Void. But that which is often meant by the Word *Æther*, or Æthereal Matter, is a very fine thin diaphanous Fluid, which ſome will have to ſurround the Earth up to as far as the Interſtellary World, and which eaſily penetrates and runs through all things, and lets all things run as eaſily through it.

ÆTHERIAL *World*, all that Space above the upper Element, *viz. Fire*, which the Ancients imagined to be perfectly homogeneous, incorruptible, unchangeable, *&c.*

ÆTHERIAL *Oil*, [with *Chymiſts*,] a fine ſubtil Oil, approaching nearly to the Nature of a Spirit.

ÆTHIOPS MINERAL, is a Medicine uſually made by incorporating well together equal Parts of running Mercury and Flour of Sulphur, and then deflagrating the Mixture.

But it is much the beſt Way only to mix them well together in a Glaſs Mortar, and never to enkindle the Matter at all; the Mercury will perfectly diſappear, and the Powder in a little time will turn black.

ÆTIOLOGY, ['Αιτιολογία, *Gr.*] ſignifies an Account of the Cauſes and Reaſons of Diſeaſes, and of their various Symptoms, in order to their Cure: Wherefore it is by ſome called *Pathology.*

AFFEERORS, a Term in Law, ſignifies ſuch as are appointed in Court Leets, *&c.* upon Oath to mulct thoſe who have committed any Fault which is arbitrably puniſhable, and for which no expreſs Penalty is preſcribed by Statute.

To *affere* an *Amercement*, is properly to leſſen and mitigate the Rigour of it.

AFFIANCE, [*in Law*,] is the plighting of Troth between a Man and a Woman, upon an Agreement of Marriage to be had between them.

AFFIDARE, to plight Faith, to ſwear Fealty.

AFFIDAVIT, [*in Law*,] ſignifies an Oath, As to make *Affidavit*, is to teſtify a Thing upon Oath.

AFFORCIAMENT, a Fortreſs or ſtrong Hold, or other Fortification.

To AFFOREST, (a Term in the *Foreſt Law*) ſignifies to lay waſte a Piece of Ground, and turn it into Foreſt.

AFFRAY, or *Affraiment*, (in the *Common Law*) is an Affrightment put upon one or more Perſons; and this may be wrought, they ſay, without a Word ſpoken or Blow given: As if a Man ſhould ſhew himſelf in Armour, or furniſhed with Weapons not uſually worn, it may ſtrike a Fear into others that are unarmed; which therefore is a common Wrong, and is inquirable in a Court Leet; wherein it differs from an Aſſault, which is always a *particular Injury*.

AFFRETAMENTUM, the Freight of a Ship, from the *French Fret*, which ſignifies the Tuns.

AFT, [æꝼtan, *Sax.*] See *Abaft.*

AFTER-SAILS in a Ship; ſee *Sails.*

AGE, [in the *Common Law*,] is that particular Time which enables a Perſon to do that which before he could not do for Want of Age: Thus at Fourteen Years a Man is ſaid to be at the *Age of Diſcretion*; and at Twenty one, at *full Age.* At Twelve Years of Age a Man may take the Oath of Allegiance at a Leet; at Fourteen he may conſent to marry, and in *Soccage* chuſe his Guardian; at Fifteen he is of Age for the Lord to have *Aid pur ſuir fitz Chevalier*, and may be ſworn to keep the King's Peace; at Twelve he is bound to Appearance before the Sheriffs and Coroner for Enquiry after Robberies.

A Woman might heretofore at Seven Years of Age, her Father being the Lord, diſtrain his Tenants for *Aid pur fill marier*, and at thoſe Years conſent to marry, ſaith *Bracton.* At Nine Years ſhe is dowable; for then, or within half a Year after, (*Fleta*, *lin.* 5. *c.* 22. *Lit. Lib.* 1. *c.* 5.) ſhe is able *promereri dotem & virum ſuſtinere.* But this *Bracton* limits to Two Years. At Twelve ſhe is able to ratify and confirm a former Conſent given to Matrimony; at Fourteen ſhe is able to receive her Lands into her own Hands, and ſhall be out of Ward, if ſhe be at that Age at her Anceſtor's Death; at Sixteen ſhe ſhall be out of Ward, though ſhe was under Fourteen at the Death of her Anceſtor; at Twenty one ſhe is able to alienate her Lands and Tenements.

AGE PRIER, (a Term in *Common Law*,) is when an Action is brought in againſt an Infant for Land which he hath by Deſcent, for then he is to ſhew the Matter to the Court, and ſhall pray that the Action may be ſtayed till his full Age of Twenty one Years, and ſo by Award of the Court the Suit ſhall ſurceaſe.

AGENT, [*in Phyſicks*,] is that by which a Thing is done or effected, or has a Power by which it acts on another, or induces ſome Change in another by its Action.

Natural AGENTS, } [with *Schoolmen*,] are
Phyſical AGENTS, } ſuch as are immediately determined by the Author of Nature to produce one Sort of Effect, with an Incapacity to produce the contrary thereto, as *Fire*, which only heats, but does not cool.

AGENT and PATIENT, [in *Common Law*,] is, when a Man is the Doer of a Thing, and the Party to whom it is done; as where a Woman endows herſelf of the faireſt Poſſeſſions of her Huſband.

Free AGENTS, } [with *Schoolmen*,] are
Voluntary AGENTS. } ſuch as may equally do any thing, or the contrary, or oppoſite to it, as acting not from any Predetermination, but from

Choice; ſuch the Mind is ſuppoſed to be, which may either *will* or *nill* the ſame Thing.

Univocal AGENTS, [with *Naturaliſts*,] are ſuch Agents as produce Effects of the ſame Kind and Denomination with themſelves.

Equivocal AGENTS, are ſuch Agents, whoſe Effects are of a different Kind from themſelves.

AGEOMETRESIA, [Ἀγεωμετρησία, *Gr.*] a Want or Defect in Point of Geometry.

AGGLUTINANTS, [*Agglutinantia*, *L.*] ſtrenthening Remedies, whoſe Office and Effect is to adhere to the ſolid Parts of the Body, and by that Means to recruit and ſupply the Place of what is worn off and waſted by the animal Actions.

AGGLUTINATION, [with *Phyſicians*,] the Addition of a new Subſtance, or the giving a greater Conſiſtence to the animal Fluids, by which they are the more fit for Nouriſhment.

AGGREGATE, is much the ſame as the Sum, ariſing from the Addition, Connection, or Collection of ſeveral things together.

AGGREGATED *Flowers*, ſuch which conſiſt of many little Flowers, meeting together to make one whole one, each of which has its *Stylus*, *Stamina*, and *Sticking Seed*, and contained in one and the ſame *Calix*.

AGGREGATION, [*in Phyſicks*,] a Species of Union, by which ſeveral things, which have no natural Dependence or Connexion one with another, are collected together, ſo as in ſome Senſe to conſtitute one.

AGGRESSES, or *Ogreſſes*, the ſame with *Pellets*; a Term in Heraldry: See *Balls*.

AGGRESSOR, is he that makes the firſt Aſſault, Attack, or that firſt begins any Quarrel, Encounter, or Difference.

AGILD, [*in Law*,] ſignifies free from Penalty, not ſubject to the cuſtomary Fine or Impoſition.

AGIST, a Term in *Law*, ſignifies to take in, and feed the Cattle of Strangers in the King's Foreſt, and to gather Money due for the ſame to the King's Uſe. The Officers doing it are called *Agiſters*, and their Office is called *Agiſtment*.

AGITATION, in general, ſignifies Motion or Action; but it is moſtly uſed in a Philoſophical Senſe for the briſk inteſtine Motion of the ſmall Corpuſcles of any natural Body. Thus Fire or Heat agitates the ſmall Particles of all Bodies, and puts them into a rapid Motion.

AGNATI, [*Civil Law*,] the Male Deſcendants of the ſame Father in different Lines.

AGNATION, in the *Civil Law*, is the Term for that Line of Conſanguinity which is between Males deſcended from the ſame Father; as *Cognation* is the Line of Parentage between Males and Females, both deſcended from the ſame Father. The Uſe of both theſe Words is derived from the old *Roman* Law.

AGOGICE, [Ἀγωγικὴ, *Gr.*] is the Art of making Images or Figures in Metals, when Wax is uſed to effect or further the Deſign.

AGRICULTURE, is the Art of Tilling, Manuring, and Cultivating the Earth, in order to render it fertile, and to make it bear Plants, Trees, and Fruits.

AGRYPNIA, [Αγρυπνία, *Gr.*] is a Kind of *Coma Vigil*, a watching or dreaming Slumber, proceeding from ſome Diſorder in the Brain.

AGRYPNOCOMA, [of Ἀγρυπνία and κῶμα, *Gr. a deep Sleep*] the ſame with *Coma Vigil*.

AID, [*in Law*,] a Tax or Subſidy; alſo an Impoſition anciently laid by the King on Tenants, &c. for marrying his Daughter, or knighting his eldeſt Son.

AID PRIER, [*in Law*,] a Word made uſe of in pleading for a Petition in Court to call in Help from another Perſon, who hath an Intereſt in the thing conteſted; it is alſo uſed in the King's Behalf to prevent any Proceeding againſt him till his Councel be called and heard what they have to ſay for avoiding the King's Prejudice or Loſs.

AIDE *of the King*, [*Law Term*,] is where the King's Tenant prays Aid of the King on the Account of Rent demanded of him by others.

AIDE, [in the *Law*,] hath ſeveral Significations; ſometimes 'tis the ſame with *Subſidy*; ſometimes a Proteſtation due from Tenants to their Lords. This Word is alſo uſed in Matter of Pleading for a Petition made in Court, for the calling in of the Help from another that hath an Intereſt in the Cauſe in Queſtion. Thus a Tenant for Term of Life, by Courteſy, Tenant in Tail after Poſſibility of Iſſue extinct, for Term of Years, at Will, by Elegit or by Statute Merchant, being impleaded touching her Eſtate, may *pray in Aid* of him in the Reverſion; that is, deſire the Court that he may be called in by Writ, to alledge what he thinks good for the Maintenance both of her Right and his own; but this Courſe hath been diſuſed. If a King's Tenant holding in Chief be demanded a Rent of a common Perſon, he may pray *in Aid of the King*, and ſo may a City or Burgh, having a Fee Farm of the Crown, when any thing is demanded againſt them belonging thereunto.

AIDE DE CAMP, AIDE DU CON, in an Army, is an Officer always following one of the Generals, *i. e.* the General, Lieutenant General, or Major General, to receive and carry their Orders as Occaſion requires. When the King is in the Field, he uſually appoints young Gentlemen of Note to carry his Orders, and they are called the *King's Aides de Camp*.

AIDE MAJOR, or *Adjutant*, is an Officer, whoſe Buſineſs it is to eaſe the Major of Part of his Duty, and to perform it all in his Abſence. Some Majors have ſeveral *Aides Majors*; each Troop of Guards hath but one Major, who hath two *Aides Majors* under him, according to the Greatneſs of the Buſineſs; every Regiment of Foot hath as many *Aides Majors* as it contains Batallions. When the Battallion is drawn up, the *Aide Major*'s Poſt is on the Left beyond all the Captains, and behind the Lieutenant Colonel.

AIGLETTE, [*in Heraldry*,] an Eaglet, or young *Eagle*. *F.*

AILE, is a Writ which lies where Land deſcends from the Grandfather to the Son or Daughter of his Son, the Father being dead before the Entry by him, and one abates, the Heir ſhall have this Writ againſt the Abator.

AIR, The admirable Sir *Iſaac Newton*, in the Obſervations mentioned in the 2d Book of his Opticks, by conſidering the colour'd Rings made by compreſſing two Priſms, or two Object Glaſſes of large Teleſcopes together, comes to a Calculation of the Thickneſs of the Air contain'd between the Priſms and Object Glaſſes in ſuch a State of Compreſſion; and at laſt he ſeems, he ſaith, to gather this Rule; That the Thickneſs of the Air is proportionable to the *Secant* of an Angle, whoſe *Sine* is a certain Mean Proportional between the Sines of Incidence and Refraction. And that mean Proportional, ſo far as by the Meaſure he took could be determined, he found was the firſt of 106 Arithmetical

tical mean Proportionals between thoſe Sines accounted from the greater of the Sines (*i. e.*) from the Sine of Refraction, when the Refraction is made out of the Glaſs into the Plate of Air; or from the Sine of Incidence, when the Refraction is made out of the Plate of Air into the Glaſs. And in *Obſervation* 14. *p.* 18. he ſaith, That the *Thickneſs* of the Air between the Glaſſes there, where the Rings are ſucceſſively made by the Limits of the ſeven Colours, *Red*, *Orange*, *Yellow*, *Green*, *Blue*, *Indico*, and *Violet*, in Order, are to one another as the Cube Roots of the Squares of the eight Lengths of a Muſical Chord which ſound the Notes in an Eighth, *Sol*, *la*, *fa*, *Sol*, *la*, *mi*, *fa*, *Sol*: That is, as the Cube Roots of the Squares of the Numbers 1, $\frac{8}{9}$, $\frac{5}{6}$, $\frac{3}{4}$, $\frac{2}{3}$, $\frac{3}{5}$, $\frac{9}{16}$, $\frac{1}{2}$.

And according to his moſt accurate Obſervations, the Thickneſs of the thinned Air, which between two Glaſſes exhibited the moſt Luminous Parts of the firſt ſix Rings of Colours, were $\frac{1}{178000}$ $\frac{3}{178000}$ $\frac{5}{178000}$ $\frac{7}{178000}$ $\frac{9}{178000}$ $\frac{11}{178000}$ Parts of an Inch.

'Tis highly probable, that true and permanent Air is made by Fermentation, (ſaith the ſame Author) and Rarefaction of Bodies that are of a very fixt Nature: Thoſe Particles flying and avoiding one another at the greateſt Force *at a Diſtance*, which when very near, *attract and adhere* to one another with the greateſt Violence.

The Particles therefore of true and permanent Air being extracted from the denſeſt and moſt fixed Bodies, will be denſer and craſſer than thoſe of Vapour; and from hence it is likely, may be heavier alſo than thoſe, and that the Parts of a humid Atmoſphere may be lighter than thoſe of a dry one, as in Fact it appears to be; by the riſing of the Mercury in dry Weather, and by Clouds and Vapours riſing into and floating in our Atmoſpherical Air. And he very juſtly thinks that the Rarefaction and Condenſation of the Air cannot be accounted for from the Spring or elaſtick Forms of the Particles, without a Suppoſition that they are endued with ſome Centrifugal Force or Power, by which they *fly and avoid one another*, and the denſe Bodies from whence they are extracted: See *Attraction*.

And that this *repelling Force*, which is the Cauſe of *Filtration*, and of the Aſcent of Water in ſmall Capillary Tubes to much greater Heights than the Surface of the Water in the open Veſſel, in which they are placed. The Air within the Tubes being much *rarer* than in more open Spaces, and by that Means not preſſing ſo much on the Surface of the Water *within* the Tubes as *without*. And this Account Dr. *Hook* had hinted at long ago. Sir *Iſaac* did, in his admirable *Prin. Philo. Mathem. Prop.* 23. *p.* 301. long ago demonſtrate, *That Particles endeavouring to recede from or avoid one another with Forces reciprocally proportional to the Diſtance between their Centers, will compoſe an elaſtick Fluid whoſe Denſity ſhall be proportionable to its Compreſſion*; and from ſuch a Property all the Appearances of our Air may be very well accounted for. And I think much better, than from the Suppoſition of its Particles being *Spires* contorted into *Spheres*, through whoſe Interſtices the Rays of Light may freely paſs, *&c.* tho' this be very ingenious; but I think can never ſolve the prodigious Rarefaction of this moſt uſeful Fluid.

AIR. The *Atmoſpherical Air*, in which we breathe, is a diaphanous, compreſſible and dilatable fluid Body, covering the Earth and Sea to a great Height above the higheſt Mountains; and differs from the Æther (among other things) in this, that it refracts the Rays of the Moon, and other remoter Luminaries. This Air ſeems to conſiſt of three differing Kinds of Corpuſcles, or ſmall Bodies.

1. Such as are carried up into it in the Form of *Exhalations* or *Vapours* from the Earth, Sea, and all animal, vegetable, and mineral Bodies, by Means of the Sun's, or the ſubterraneal Heat.

2. There are yet a more ſubtle ſort of Particles in the Air, which we may reckon emitted into it from the Heavenly Bodies; and alſo the Magnetick Streams of this Globe of Earth and Water. But,

3. There is alſo a third Kind of Particles, which perhaps do moſt properly merit the Name of *Aereal*, as being the proper and diſtinguiſhing Parts of *Air* taken in the ſtricteſt Senſe; and theſe are Corpuſcles which are conſtantly *Elaſtical* or *Springy*. For *Elaſticity* is an eſſential Property of Air, and it is thought no other Fluid hath any thing of it, but only ſo far as it participates of Air, or hath Air contained in its Pores. So that our Air probably doth either conſiſt of, or abound with Parts of ſuch a Nature, that in caſe they be bent or compreſſed by the Weight of the incumbent Part of the Atmoſphere, or of any other Body, they do endeavour to free themſelves from that Preſſure, by bearing againſt the Bodies that kept them bent; and as ſoon as theſe Bodies are removed to give them Way, they unbend themſelves, either quite, or ſo far forth as the Bodies that reſiſt them will permit, and thereby expand the whole Parcel of Air, theſe elaſtical Bodies compoſe.

Dr. *Hook*, in his *Micograph.* pag. 13. ſeems to think the Air to be nothing elſe but a kind of Tincture or Solution of terreſtrial and aqueous Particles diſſolved in, and agitated by the Æther; and theſe Particles he ſuppoſes to be of a ſaline Nature.

Mr. *Boyle* found, that one and the ſame Portion of Air may make up 52000 times the Space it doth at another Time. See *Tracts about the admirable Rarefaction of the Air*. And in the ſaid Diſcourſe he tells us, That he found by undoubted Experiments, that the ſame Quantity of Air, by only having the Preſſure of the Atmoſphere taken off in the Pneumatick Engine, and without any adventitious Heat to increaſe its Spring, would poſſeſs above 13000 times its natural Space or Dimenſions.

Dr. *Gregory*, in his *Aſtron.* p. 401. ſhews, that if Air expand it ſelf according to Mr. *Boyle*'s obſerved Law, *viz. That the Spaces into which it may be compreſſed, are always reciprocally proportional to the compreſſing Weight*; then a Globe of Air of the Diameter of one Inch, if rarefied ſo, as (according to that Rule) it muſt be at the Diſtance of the Earth's Semi-diameter (from the Earth) will fill the Planetary Regions as far as, and much beyond the Sphere of *Saturn*.

And the great *Dilatation* and *Compreſſion* of Air may be eaſily enough conceived, without the Intervention of any ſubtile Matter, if we imagine each proper elaſtick Particle of Air to be like a little Spring of a Watch coiled up round, or wound up like a Piece of Ribbon: For, if you allow further, that theſe Particles have alſo a circular Motion round their own Axis, the Parts of each *Roll*, *Coil*, or *Lamina*, will endeavour to recede from the Axis of its Motion, and this more or leſs, according to the Velocity of their Motion;

by which Means they will acquire a Springineſs outward like a Watch Spring, and will endeavour to fly or unwind themſelves out to their full Length, but that they are hindred by other ſuch Particles on every Side: And therefore theſe elaſtick Particles in the lower Parts of the Atmoſphere, will always be kept bent or wound up by the Weight of the whole of the Air; but if at any Time they can get rid of this Weight and external Preſſure, they will readily, by their natural Spring, evolve themſelves, and extend their Roll or Circles to vaſtly large Dimenſions. And this may be the Reaſon of the Tumeſcence of a Bladder not apparently blown out in the exhauſted Receiver; of a full blown one (if dry) breaking there, and of the breaking of ſquare figured Vials, when ſtop'd well, and the Air thoroughly drawn off from them.

And 'tis equally eaſy to conceive, that a great Dilatation or Rarefaction of Air may be produced by Heat; for the rapid Motion of the calorifick Particles muſt needs ſo move the aereal ones, and by that Means may make them more endeavour to recede from the Axis of their Motion, and conſequently more unwind or unroll themſelves; wherefore they muſt take up more Space, and muſt more thruſt, by this increaſed Spring, all other Bodies from them, and ſeparate themſelves from one another.

Mr. *Boyle*, in his Diſcourſe againſt *Linus*, ſhews, that the *Strength required to compreſs Air, are in reciprocal Proportion (nearly) to the Spaces comprehending the ſame Portion of Air.*

AIR's *Reſiſtance*: See *Reſiſtance*.

AIR's *Weight*, in Proportion to the ſame Bulk of Water, ſeems pretty nicely determined by an Experiment lately made before the Royal Society by the ingenious Mr. *Hauksbee*. (See *Phil. Tranſ. N.* 305.) to be nearly 885 to 1.

AIR's *Weight*. The Weight of the Air was firſt diſcovered by the great *Galileus*; who finding that Water by pumping could be raiſed no higher than 34 or 35 Feet, concluded, that the Notion of an infinite *fuga vacui* would not do in this Caſe; and therefore happily fell on thinking of the Counter-Balance of the Air's Weight, which *Torricellius* afterwards purſued and improved with like Sagacity; inventing, as a farther Proof of the Notion of the Gravity of the Air, that which we call the *Torricellian Experiment*.

Mr. *Boyle* found a Lamb's Bladder containing about two Thirds of a Pint, and blown up, and well dried, to loſe about a Grain and one Eighth when it was prick'd, and the Air let out.

Alſo, that a Lamb's Bladder being counterpoized in a nice Pair of Scales in the Receiver, on the Air's being drawn out, did manifeſtly preponderate; but when the external Air was let in again, the Scales returned to their former Equilibrium.

An Æolopyle well heated, and then having its little Hole ſtopt, was cooled and weighed; after which the Hole being opened, the Air was heard plainly to ruſh in with a whiſtling Noiſe, and then the Æolopyle being weighed again, it was manifeſtly heavier than before.

The *Magdeburgick* Engine being weighed when full of Air, and afterwards being again weighed when it was well exhauſted, was found to weigh an entire Ounce and three Tenths leſs than it did before.

And Mr. *Boyle* found by accurate Experiments, that a ſmall Receiver weigh'd 35 Grains more, when full of Air, than after it was exhauſted. He found alſo, that A Glaſs Bubble as big as a Hen's Egg, having as much Air as could be driven out by Heat, had then its Stem nimbly ſealed up, and then being left leiſurely to cool (for there is great Danger of its breaking) was put into a nice Balance, and then the Scales were equipoized: After, the ſealed End being warily broken off, the Air was heard to ruſh in with a whiſtling Noiſe, and then the Scale in which the Bubble was did manifeſtly preponderate by near $\frac{3}{4}$ of a Grain. And after this, filling it with Water, it was found to hold 906 Grains of that Liquor; ſo that allowing for one Fourth of the Cavity of the Bubble's being filled with Air, which perhaps might weigh about a Grain, the Proportion of Water to Air appears in Weight to be about 905 to 1, and roundly it may be ſuppoſed as 1000 to 1, becauſe it is not poſſible but that ſome Air muſt remain in the Bubble more than is now accounted for.

The ſpecifick Gravity of Air to Water, according to Mr. *Boyle*, is as 1 to 1000: But comparing his Experiment with the Obſervations of Dr. *Halley* and Sir *Iſaac Newton*, its Denſity appears to be nearer, as 1 to 800; and the Denſity of Mercury to Water being as 14 to 1, the Denſity of Air to Mercury will be as 1 to 11200: So that the Air we breathe in takes up 11200 times the Space that a like Quantity of Mercury would. And yet the Air by Experiment hath been found, without any adventitious Heat, by the Force of its own Spring, to poſſeſs 13000 times the Space it does when preſſed by the incumbent Atmoſphere; and therefore, it may poſſeſs a Space of 145600000 times greater than the ſame Weight of Mercury, and by Addition of Heat, it may be forced to fill a Space yet much larger. Now if we conſider the Air we breathe in may be compreſſed into 40 times leſs than that which it now fills, it may then poſſeſs a Space 520000 times greater at one time than another; for $13000 x 40 = 520000$.

Our Bodies are equally preſſed upon by the incumbent Atmoſphere, and the Weight they ſuſtain is equal to a Cylinder of Air, whoſe Baſe is equal to the Superficies of our Bodies. Now a Cylinder of Air of the Height of the Atmoſphere, is equal to a Cylinder of Water of the ſame Baſe, and 35 Foot high, as appears by the Experiment of Pumping: So that every Foot ſquare of the Superficies of our Bodies, is preſſed upon by a Weight of Air equal to 35 cubical Feet of Water; and a cubical Foot of Water being found by Experiment to weigh 76 Pound *Troy* Weight, therefore the Compaſs of a Foot ſquare upon the Superficies of our Bodies, ſuſtains a Quantity of Air equal to 2660 *l.* for $76 x 35 = 2660$; and ſo many Foot ſquare as is upon the Superficies of a Body, ſo many times 2660 *l.* does that Body bear; ſo that if the Superficies of a Man's Body was to contain 15 ſquare Feet, which is pretty near the Truth, he would ſuſtain an equal Weight to 39900 *l.* for $2660 x 15 = 39900$, which is above 13 Tun. The Difference of the Weight of Air which our Body ſuſtains at one time more than at another, is alſo very great. The whole Weight of Air which preſſes upon our Bodies when the Mercury is higheſt in the Barometer, is equal to 39900 *l.* The Difference therefore between the greateſt and the leaſt Preſſure of Air upon our Bodies, may be proved to be equal to 3982 *l.* The Difference of the Air's Weight at different times, is meaſured by the different Height to which the Mercury is buoyed up in the Barometer; and the greateſt Variation of the Height of the Mercury being three Inches, a Column of Air of any aſſignable Baſe equal to the Weight of a Cylinder of Mercury of the ſame Baſe, and the Altitude of three Inches, will be taken off from the Preſſure upon a Body of an equal Baſe, at ſuch times as the Mercury is three Inches lower in the Barometer; ſo that every Inch ſquare of the Surface of our Bodies is preſſed upon at one Time more than another, by a Weight of Air equal to three cubical Inches of Mercury. Now a cubical Foot of Water being 76 *l.* a cubical Foot of Mercury muſt be 1064 *l.* = 102144 Drams. And as 102144 Drams is to a cubical Foot, or which is all one, 1728 cubical Inches :: $59\frac{192}{1728}$ Drams to one cubical Inch; ſo that a cubical Inch of Mercury (throwing away the Fraction, which is inconſiderable) is = 59 Drams; and there being 144 ſquare Inches in a Foot ſquare, therefore a Maſs of Mercury of a Foot ſquare baſe = 144 Inches ſquare, and three Inches high, muſt contain 432 cubical Inches of Mercury, which × 59 (the Number of Drams in a cubical Inch of Mercury) makes 25488 Drams; and this Weight does, a Foot ſquare of the Surfaces of our Bodies, ſuſtain at one time more than at another. Suppoſe again the Superficies of a human Body = 15 Foot ſquare, then would the Body ſuſtain at one time more than at another, a Weight = 15 × 25488 = $\frac{382320}{8}$ Drams, (= $\frac{47790}{12}$ Ounces) = $3982\frac{1}{2}$ *l.* *Troy.*

Hence it is ſo far from being a Wonder, that we ſometimes ſuffer in our Health by a Change of Weather, that it is the greateſt we don't always do ſo; for when we conſider that our Bodies are ſometimes preſſed upon by near a Tun and a half Weight more than at another, and that this Variation is often very ſudden, 'tis ſurprizing that every ſuch Change ſhould not entirely break the Frame of our Bodies to Pieces; and the Veſſels of our Bodies being ſo much ſtraitned by an increaſed Preſſure, would ſtagnate the Blood up to the very Heart, and the Circulation would quite ceaſe, if Nature had not wiſely contrived, that when the Reſiſtance to the circulating Blood is greateſt, the *Impetus* by which the Heart contracts ſhould be ſo too; for upon Increaſe of the Weight of the Air, the Lungs will be more forcibly expanded, and thereby the Blood more intimately broken and divided, ſo that it becomes fitter for the more fluid Secretions; ſuch as that of the nervous Fluid, by which the Heart will become more ſtrongly contracted; and the Blood's Motion towards the Surface of the Body being obſtructed, it will paſs in greater Quantity to the Brain, where the Preſſure of the Air is taken off by the *Cranium*, upon which Score alſo more Spirits will be ſeparated, and the Heart on that Account too more enabled to carry on the Circulation through all paſſable Canals, whilſt ſome others towards the Surface are obſtructed. The moſt conſiderable Alteration made in the Blood upon the Air's greater or leſſer Preſſure on the Surface of our Bodies, is rendring the Blood more or leſs compact, and making it croud into a leſs, or expand into a greater Space in the Veſſels it runs in: For the Air contained in the Blood always keeps itſelf *in Equilibrio* with the external Air that preſſes upon our Bodies; and this it does by a conſtant *Niſus* to unbend itſelf, which is always proportional to the compreſſing Weight by which it was bent; ſo that if the Compreſſion or Weight of the circumambient Air be ever ſo little abated, the Air contained within the Blood unfolds its Spring, and forces the Blood to take up a larger Space than it did before. For further Effects of the Changes of Air upon human Bodies, ſee *Mead de Imperio Solis ac Lunæ in Corpora humana*; *Mainwright*'s *Nonnaturals*; *Sanctorius*'s *Medicina Statica*, with Explanations; and particularly what is here under the Term *Reſpiration.*

AIR PUMP, an Inſtrument to exhauſt the Air out of proper Veſſels. Mr. *Boyle* owns he had the firſt Hint of it from *Schottus*, who had publiſhed to the World, (but Mr. *Boyle* had not ſeen the Book) that one *Otto Gerick*, Conſul of *Magdeburg*, had found out a Way of evacuating Glaſs Veſſels, by ſucking out the Air at the Mouth of the Veſſel, plunged under Water. But this Engine was defective in two Reſpects. 1. That in order to evacuate the Veſſel, there was required the continual Labour of two ſtrong Men for two Hours. 2. The Receiver and Engine being all of one Piece, there was no way to get things in and out of it, in order to try any Experiment upon them. To remedy which, and to ſupply thoſe Imperfections which Mr. *Boyle* had heard the *Otto Gerick* Engine laboured under, he directed one Mr. *G.* and Dr. *Hook*, to contrive a new and better *Air Pump*; a Deſcription of which, as now improv'd, is as follows:

It conſiſts of two Braſs Barrels or Cylinders, as repreſented by *a a a a*, 12 Inches in Height, and two their Diameters within; the Suckers, or *Emboli*, are raiſed and depreſſed by turning the Winch *b b* backward and forward. The Winch is faſtened to a Spindle that paſſes through a Lantern, whoſe Pins perform the Office of Cogs; for in its Motion they lay hold on the Teeth of the Racks *c c c c*, and ſo reciprocally as one is depreſſed, the other is elevated; by which Means the Valves, which are made of limber Bladder, and fix'd on the upper Part of each *Embolus*, as well as at the Bottom of the foremention'd Cylinders, perform their Offices mutually of exhauſting and diſcharging the ſame Air taken from the Recipient on the Plate of the Pump; and when the Recipient comes to be pretty well exhauſted of its contain'd Air, the Preſſure of the outward Air on the deſcending Sucker is nearly ſo great, that the Power required to raiſe the other is very little more than what ſurmounts the Friction of the moving Parts, which renders the Pump preferable to all others; for, in the working of them, the nearer they approach a *Vacuum*, the greater is their Labour: But this that I am now deſcribing (under the ſame Circumſtances) is quite contrary.

The Bottom of the Barrels are placed in a Braſs Diſh, repreſented by *d d*, whoſe Sides are about two Inches high, and is on Purpoſe to put Water in, to keep the Leather Collars (on which the Braſs Cylinders ſtand) moiſt, whereby the Air is prevented from inſinuating into the Cylinders into thoſe Parts. The Cylinders are ſcrewed down on the ſame by the Nuts *e e e e*, which force the Frontiſpiece *f f* down on them, thro' which the two Pillars *g g g g* paſs. The Pillars have an Iron belonging to each of them, and paſs from them in the Form of a Swan Neck, decipher'd by *g g*, which Irons are faſtened to the hinder Part of the Frame, for their better Security from ſhaking. From between the two Braſs Barrels ariſes a Braſs hollow Wire, *h h h h*, which hath a Communication with each of them, by Means of a perforated Piece of Braſs which lies along horizontally from one to the other. The upper End of this hollow Wire is faſtened to another Piece of perforated Braſs, which ſcrews on underneath the Plate *i i i i*, which is 10 Inches over, and has a Braſs Rim ſolder'd on it, to prevent the ſhedding of Water; for which there is Occaſion

Place this Fnd" Air Pump

Plate. I.

Air Pump with its Apparatus for Showing Attraction by Attrition.

Air Pump

Fig: I

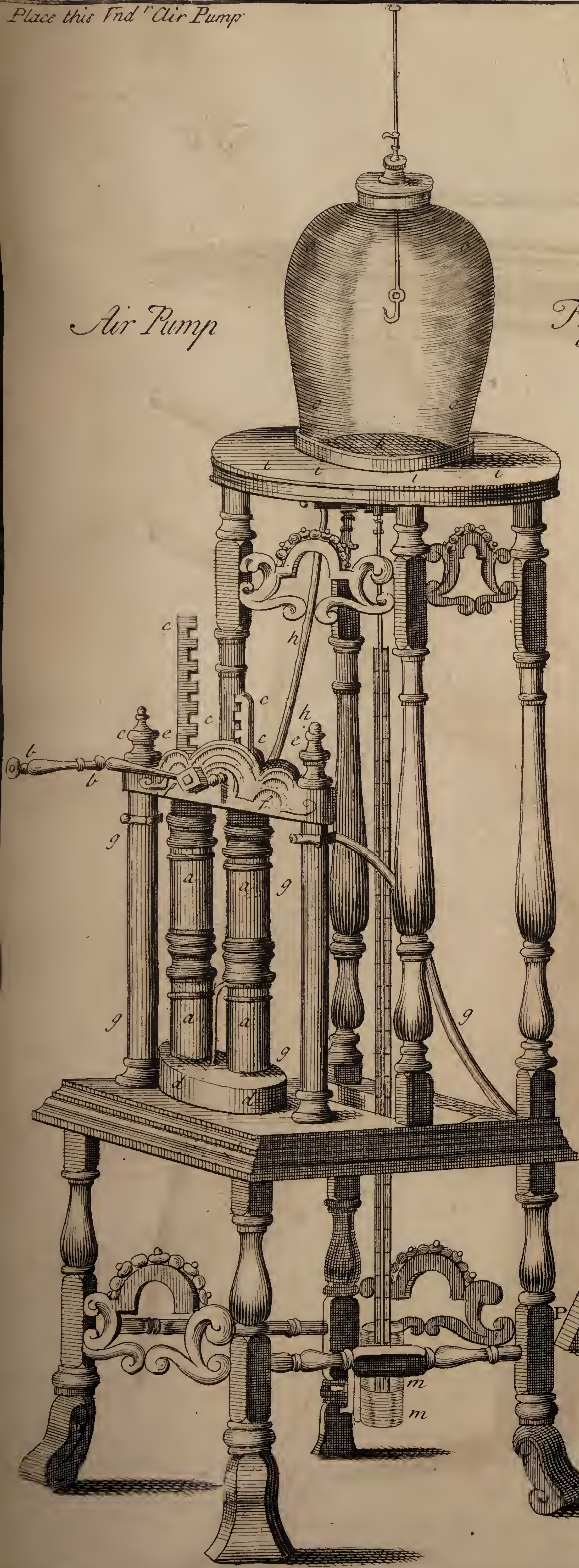
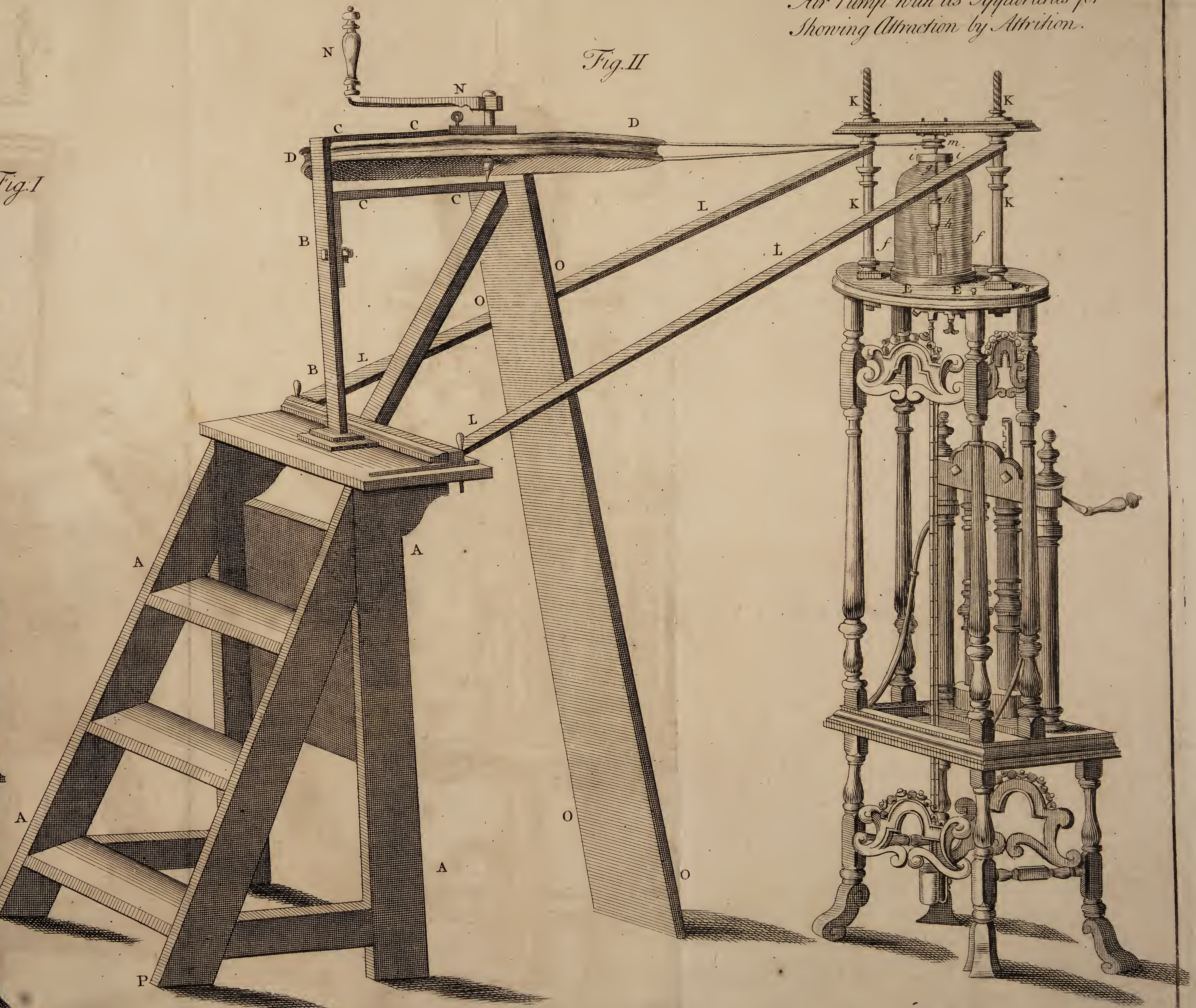
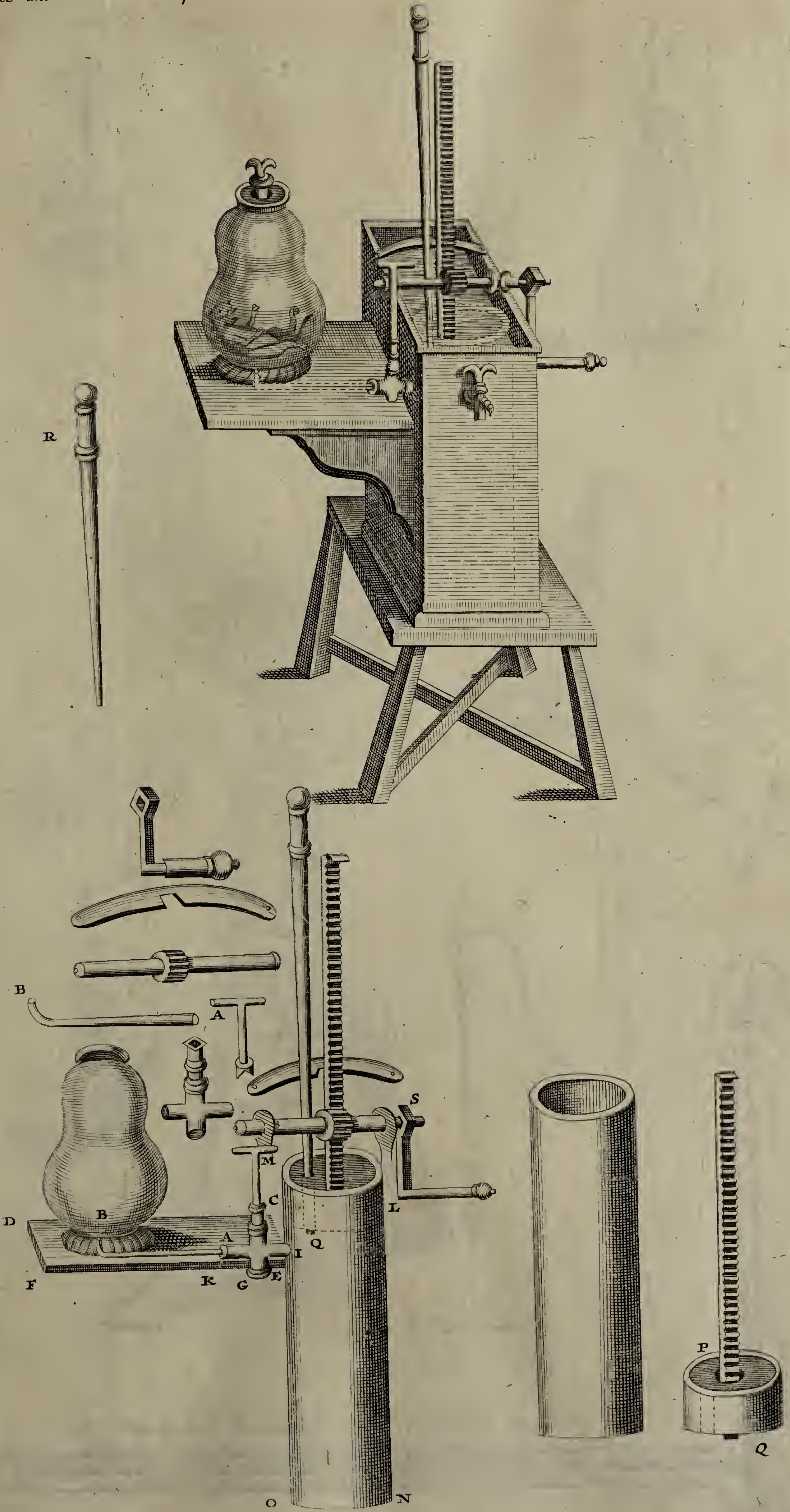


Fig. II



B. Cole. Sculp.

Place this under Air Pumps.



Place this under Air Pumps.

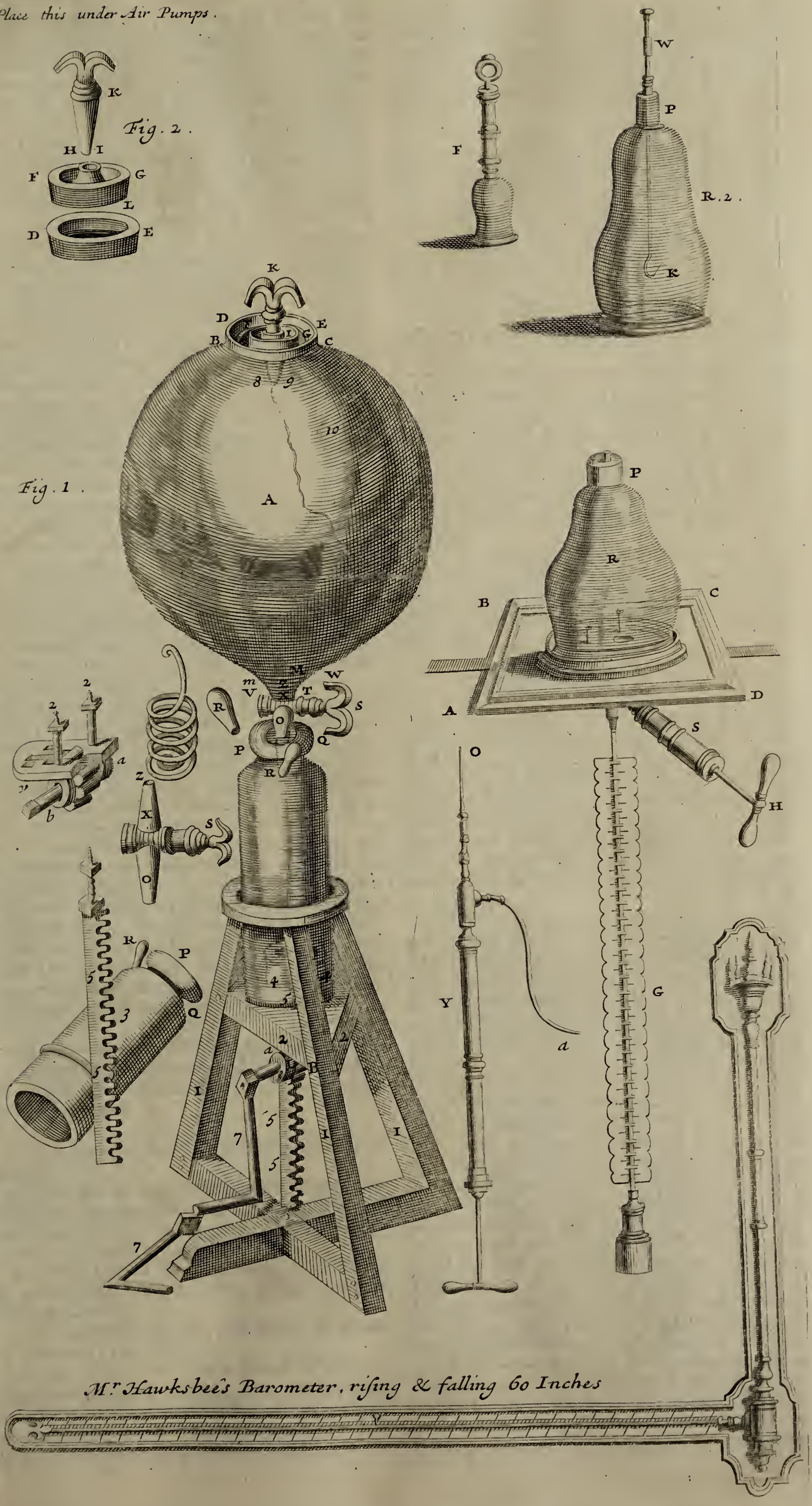


Fig. 2.

Fig. 1.

Mr. Hawksbee's Barometer, rising & falling 60 Inches

in ſeveral Experiments. Between the Middle and the Side of this Plate ariſes a ſmall Pipe *k*, about an Inch and a half in Height, through which into the forementioned hollow Wire paſſes all the Air into the Barrels, as it is taken from the exhauſting Receiver. Upon the Plate of the Pump is always laid a wet Leather; on which the Recipients are placed: This wet Leather prevents the Air's getting into the Glaſſes, whoſe Edges are truly ground, and is of Uſe for that Purpoſe beyond any Cement whatſoever, and not only ſecures it from the Air's Ingreſs that Way, but by the Uſe of it we can make ſeveral Experiments in the ſame time they formerly could make one, without any Daubing or Difficulty. Another Excellency in this Pump is, the Contrivance of the Gage, denoted by *l l l l*, which Gage is a glaſs Tube about 34 Inches long, and is ſo placed that it cannot eaſily receive Damage, and is altogether out of the Way of any thing that is experimented on the Pump. It's lower Orifice is plung'd in a Glaſs of Mercury, deſcrib'd by *m m*, on the Surface of which is laid a Piece of Cork with a Hole in the Middle for the glaſs Tube to paſs through: On this Cork is placed a Board made of Box Wood, about an Inch in Breadth, and groov'd in the Middle, to receive the forementioned Glaſs Tube, which is looſely loop'd on to the ſame by two braſs Loops, that it may have the Liberty of riſing and falling as the Mercury aſcends or deſcends in the Gage. To the upper Part of this Tube is cemented a braſs Head, which braſs Head fits into the forementioned perforated braſs Piece that is ſcrewed on under the Plate, and has a Communication as well with the Recipient on the ſame, as with the hollow braſs Wire *h h h h* paſſing between the two Barrels. The box Board is graduated into Inches and Quarters, from the Surface of the Quickſilver to 28 Inches high; from thence it is divided into Tenths of Inches. By this Gage the Degrees of Rarefaction in any Experiment are at all times moſt nicely to be obſerved. The Air-Cock *n*, which lets in the Air, is likewiſe a Screw on the ſame forementioned perforated Braſs, in which the upper Parts of the Gage and hollow Wire are inſerted: *o o o o* repreſents a Receiver ſtanding on the Plate of the Pump, on whoſe upper Part *p p*, thro' a Box of Collars of Leather paſſes a Slip-wire, whoſe Office is to take up, let fall, or ſuſpend any thing at any determinate Height, in the Receiver, without the Air's Inſinuation.

A Deſcription of the Air Pump being before given, I ſhall forbear taking any further Notice of it, ſaving what immediately relates to the following Experiments.

A A A A is a Ladder, ſuch as is generally uſed in Houſes.

B B is a Bar of Iron, which paſſes through the Middle of the upper Step, and is faſtened to the Back-board of the Ladder by two Nuts and Screws through both the Board and Iron.

C C, the Jaws of the Iron Frame, which holds the great Wheel *D D*, of 23 Inches Diameter within its Groove.

E E, the Braſs Plate of the Air Pump, on which the Recipient *f f* is placed.

g g, the Spindle, to which Bodies of different Magnitudes may be faſtened, by a Hole paſſing through the Middle of them ſufficient to receive the Spindle, and by Means of the two Nuts *h h*, a larger or a ſmaller Body may be ſcrewed faſt on.

i i is a Braſs Plate turn'd true to the ground Edge of the Recipient on which it is plac'd, having a Braſs Box in the Middle of it, which is full of Collars of Leather well oiled, through which the Spindle paſſes, the Hole of the Braſs being likewiſe juſt fit to receive it.

k k k k, two Pillars, with Nuts to ſcrew down a Piece of Board, which has an Iron faſtened to it to receive the upper Point of the Spindle, the lower one falling into a Braſs Socket, ſcrew'd to the Middle of the Plate of the Air Pump.

L L L L, the Supporters, reaching from the upper Board of the Ladder to the Pillars, to prevent the Recipient's being drawn from its Place by the Motion and Tugg of the Wheel-band.

m m, the ſame Wheel, which the Band from the great one ſurrounds, and is an Inch and half Diameter.

N N, the Winch which gives Motion to the whole, the ſmall Wheel *m m* making about fifteen Revolutions to one of the large Wheel *D D*; ſo that a Body faſten'd to the Spindle *g g* of the ſmall Wheel *m m*, will be turned 15 times round to once of the great Wheel; and according as that ſhall exceed in Diameter the ſmall Wheel, ſo will the Velocity of the Motion of the extreme Parts be proportionably increaſed.

o o o o, a ſtrong Board reaching from the lower Jaw of the Machine to the Ground, for the Support, of giving a ſteady Motion to the great Wheel.

p p are two Screws which faſten the Ladder to the Floor.

Experiments on the Air Pump.

1. Take a Bladder, and ſqueeze out the Air ſo as to leave only what remains in the Folds of the Bladder, then tie it cloſe, and ſeal it ſo that the Air cannot eſcape; lay the Bladder on the Air Pump, and fit a Receiver over it, then exhauſt the Receiver, and the Air in the Bladder will expand itſelf ſo as to blow up the Bladder; when you let in the Air, the Bladder will return to its former Shape; which ſhews the Expanſion of the Air by its Spring or Elaſticity.

2. To know how much the Air expands itſelf, take a Glaſs Bubble of about an Inch Diameter, with a Stem of about ſix or eight Inches, fill it almoſt all full of Water, except a very ſmall Bubble of Air, then inverting this Bubble or Bolt-head into a Jar of Water, cover the whole with a Receiver, which exhauſt, and the little Bubble of Air will expand itſelf; ſo that by comparing the Bigneſs of the ſaid Bubble of Air as it was at firſt, to its Bigneſs when expanded, you will know the Proportion of the Expanſion of the Air.

3. Take an Egg and break off evenly about a third Part of the Shell at the little End, and put the Yolk and White out of the Shell, and at the Bottom you will ſee a ſmall Bubble of Air which lies between the Skin and the Shell; ſet the Egg up in ſome little open Glaſs on the Pump, and put a ſmall Receiver over it, and when you exhauſt the Receiver, the Air in the Shell will expand itſelf, and raiſe up the Skin, ſo as to fill the Shell, and appear like a whole Egg. Or, take an Egg, and make a ſmall Hole in the little End, and invert it in a ſmall Glaſs, and ſet it on the Plate, and ſet a Receiver over it, and when you exhauſt the Receiver, the Air in the Bubble will expand itſelf ſo as to force all the Egg out of the Shell through the Hole in the End; then let in the Air, and if the

Shell be kept down, it will all return again into the Shell; which likewiſe ſhews the Expanſion of the Air by its Spring.

4. Take the Flint Glaſs Bottle with the Braſs Head, and put a little Mercury in the Bottom, then take the Tube which is made for that Purpoſe, and ſcrew it into the Hole, ſo that the End may always touch the Bottom of the Bottle, then ſetting the Receiver with the large Tube to cover the ſmall one over Bottle and Tube, as you exhauſt it, you will ſee the Mercury riſe in the Tube, according to the Expanſion of the Air in the Bottle, (which when the Receiver is quite exhauſted) will ſtand at the Height of the Mercury in the common Barometer. *Note*, if you compare the Height of the Mercury in the Gage under the Pump, with the Height of the Mercury in the Tube of the Bottle aboveſaid, they will appear to be of the ſame Height, which ſhews that the Spring of the Air is juſt equal to the Preſſure of the Atmoſphere.

5. Take Glaſs Bubbles and hollow Glaſs Images, ſo far filled with Water as to make them ſink in a Jar of Water, the whole being ſet under a Receiver, and upon drawing out the Air, the Bubbles and Images will riſe up to the Top of the Water, but ſink down again as you let in the Air.

6. The ſame Experiment may be made by a Bladder half filled with Air, and juſt ſunk with Weights.

7. Take a Bladder and ſqueeze out ſome of the Air, ſo that it will go into a wooden cylindric Box, then lay a Plate of Braſs over the Bladder, and ſcrew a Wire into the Middle of the Plate about nine Inches high, lay on that Plate Leaden Weights, of what Weight you pleaſe, with Holes in the Middle to receive the Wire; put it on the Pump, with a large Receiver over it all, then the Receiver being open at the Top, lay on a wet Leather and a Plate of Braſs, with a Piece of hollow Wire in the Middle, to receive the Wire in the other Plate, and to go alſo into the Holes of the Weights; then exhauſt the Receiver, and the Air in the Bladder will expand itſelf, and raiſe up the Weights, though you have above 40 *l.* then let in the Air, and the Weights will come down as before.

8. Take a ſmall Tube about five Inches long, and cement it into a braſs Screw, which will fix it to the Bottle which you uſe for raiſing the Mercury, then tie a ſmall Bladder upon the End of the Tube which goes into the Bottle, and ſeal it tight, ſo that the Air cannot eſcape any where but through the Tube; ſqueeze the Bladder together, and having put it through the Screw Hole into the Bottle, ſcrew the Braſs Screw with a Leather upon it tight into the Bottle, having firſt blown up the Bladder within the Bottle before you fix the Screw, ſo make it tight with a Key, and ſet the Machine on the Pump with a Receiver over it; when you begin to exhauſt, the Air in the Bottle will expand itſelf, and preſs the Bladder together, which ſhews how the Lungs of an Animal *in vacuo* are preſſed together by the Expanſion of the Air in the *Thorax*, becauſe the Lungs having a Correſpondence with the Receiver through the Windpipe, have no Air in them in ſuch a Caſe, to keep up the Lungs againſt the Expanſion of the Air, in the Cavity of the *Thorax* which preſſes againſt the Outſide of the Lungs; as the Air in the Bottle in this Experiment cauſes the contain'd Bladder to ſubſiſt *in vacuo*.

9. Cats, or other Animals, die *in vacuo*, if the Air is not let in again very ſoon.

10. Fiſhes put in a Jar of Water under a Receiver, will, when the Receiver is exhauſted, riſe up to the Top of the Water, without being able to go down to the Bottom, becauſe the Air in their Wind-bladder, being expanded againſt their Will, makes them ſpecifically lighter than Water: Sometimes the Bladder breaks, and then they ſink to the Bottom, whence they can riſe no more. *N. B.* Fiſhes, Frogs, and other Animals that live in Water, will not die by exhauſting the Air from the Receiver.

11. Take a ſquare Vial, and put in a Cork, then ſeal it ſo that no Air can eſcape, and put it into a Cage of Wire, then ſet on the Pump with a Receiver over it, and when you begin to exhauſt, the Air in the Bottle will expand itſelf ſo as to break it: When you have made this Experiment, wipe your Leather and your Pump-plate, ſo that none of the Glaſs remain, for it may ſpoil another Experiment.

12. The ſame Experiment is to be made with the Bottle and Cage under Water, in which Caſe the Shock will be ſo great as to ſhake the whole Pump.

Experiments to ſhew the Spring of the Air in the Pores of Bodies.

13. Take an Apple, as much ſhrivelled as can be had, and lay it on the Pump, ſet a Receiver over it, as you exhauſt the Receiver, the Apple will appear as ſmooth as one freſh gathered; let in the Air, and it will return to its former Shape.

14. Take a ſmall Jar or Cup, and fill it almoſt full of ſmall Beer, then taſte it, and ſet it on the Pump, and put a Receiver over it, and when you exhauſt the Receiver, the Air in the Beer will expand itſelf, and cauſe the Beer to riſe up in a Froth, ſo as to come quite over the Glaſs, then let in the Air, and taſte the Beer, and you will find it quite dead.

15. Take a ſmall Jar or Cup, and fill it with luke-warm Water, and ſet it on the Pump with a Receiver over it, and when you exhauſt the Receiver, the Air in the Water will expand itſelf, and raiſe large Bubbles, ſo that the Water which was luke-warm will ſeem to boil, and diffuſe its Heat ſo as to warm the Receiver all over; then let in the Air, and it will immediately ceaſe to bubble.

16. Take a Piece of Cork, and fix it to a Piece of Lead, ſo as to poize the Cork that it will but juſt ſink in Water, then take a Glaſs Jar full of Water, and put in the Cork and Lead, which ſet on the Pump with a Receiver over it, and when you begin to exhauſt the Air in the Pores of the Cork, it will expand itſelf ſo as to ſwell the Cork, which therefore becoming lighter than an equal Bulk of Water, will riſe up to the Surface, then let in the Air, and the Cork will ſink to the Bottom again.

17. Take boiled Water, and having after drawn as much Air out of it as can be done by the Pump, put a Piece of raw Fleſh into the Water, and you will find, upon pumping out of the Air, that Air that was contain'd in the Fleſh will extricate itſelf in Time, bubbling up through the Water. *N. B.* There is Air in Blood, and all animal Fluids.

Experiments to ſhew the Preſſure of the Air.

18. Take a Glaſs open at both Ends, of about two Inches Diameter, and of what Height you

pleaſe, ſet it on the Pump, then lay on your Hand ſo as to cover the Glaſs, then begin to exhauſt, and you will feel the Preſſure of the Air; for the Air being taken from under your Hand out of the Glaſs, the external Air will preſs your Hand to the Glaſs, ſo that you can ſcarcely move it; upon letting in the Air it will be looſened again.

N. B. The Spring of the Air in your Fleſh is alſo ſhewn by this Experiment, the Fleſh of the Inſide of your Hand ſwelling downward within the exhauſted Glaſs.

19. Take a Glaſs that is open at both Ends, then take a Bladder and wet it well, ſtretch it over the largeſt End of the Glaſs, which muſt be at leaſt four Inches wide, then tie it and let it dry on, and when it is dry, ſet it on the Air Pump with the Bladder uppermoſt; then exhauſt the Glaſs, and the external Air will break the Bladder with a large Report.

20. Take a Piece of common Window Glaſs, and lay it upon the Mouth of the Receiver, or braſs Ferril, and ſet it on the Air Pump; exhauſt the Receiver, or Braſs Ferril, and the external Air will break the Glaſs all to Pieces, in the ſame Manner as the Bladder in the other Experiment.

21. Take a ſquare Bottle, and cement on a Cap of Braſs, with a Place for a Valve, then tie a ſmall Piece of wet Bladder over the Hole, ſo that the Air can come out, but cannot return the ſame Way; then put it in the Cage of Wire, and ſet it on the Air Pump with a Receiver over it, and when you exhauſt the Receiver, the Air in the Bottle will come out through the Valve; when you have quite exhauſted the Receiver, then let in the Air on a ſudden, which will endeavour to get into the Bottle, but not being able becauſe of the Valve, it will break the Bottle all to Pieces.

22. Take a Couple of braſs Hemiſpheres, and ſet them upon one another, with wet Leather which has a Hole in the Middle, in order to make them tight, and having ſcrewed a Cock into one of them, fix it to the Pump by Means of a double Male Screw, always obſerving to have oiled Leathers between the Screws; when you have exhauſted the Hemiſpheres, turn the Cock to ſhut their Communication with the Pump; take off the Hemiſpheres, and they will ſtick ſo faſt as to require a great Force to pull them aſunder, about 140 *l.* if their Diameter be equal to three Inches and a half, and proportionably more or leſs, according to their Diameters, the Weight required to draw them aſunder being greater or leſs, juſt as the Square of the Diameters of the Hemiſphere is greater or leſs than the Square of three Inches and a half, in which Caſe the Weight is 140 *l.* *N. B.* You muſt ſcrew two Rings to the exhauſted Hemiſpheres, and draw them aſunder with a ſtrong Steel-yard.

23. Take the Plate of Transferrer (which is a Six Inch Plate) and having by Means of its Cock fixed it to the Pump, ſcrew a ſpouting Tube to the upper Part of it at the End of the Cock Screw, which comes through the Plate; put a wet Leather upon the Plate, and then ſet it upon the talleſt Receiver you have; exhauſt it, and having turn'd the Cock, take it off the Pump; hold the exhauſted Machine over a Baſon of Water, and having put the Mouth of the Cock under Water, open the Cock, and the Atmoſphere will, by its Preſſure, force the Water up into the evacuated Receiver, making a pleaſant Fountain.

24. Having exhauſted the tall Receiver abovementioned, and taken it from the Pump, take a pretty large glaſs Fountain, or braſs one, with its Force-pipe ſcrewed into it, but without its Adjutage or Spouting-pipe; let this Fountain be half full of Water (no Air being condenſed over the Water) and having ſcrewed the Cock of the Plate to it, turn the Cock, and the Air in the Fountain will by its Spring preſs ſo hard upon the Water under it, as to cauſe it to riſe through the Force-pipe quite into the exhauſted Receiver, ſpouting up in a pleaſant Manner, as above.

25. Take a pretty tall open Receiver, and having ſet a Gallipot half full of Mercury upon the Plate of the Pump, take the four Inch Plate and ſcrew it to the Glaſs Tube that has a double Male Screw faſtened to the End of it, ſo that when the Plate (with a wet Leather under it) is ſet upon the Receiver, the End of the Glaſs Tube may dip into the Mercury in the Gallipot; then ſcrew the little Spring upon the upper Screw of the ſaid Tube, above the Plate and Receiver, gently lift up the Piſton of the Syringe, and you will ſee the Mercury riſe out of the Gallipot into the glaſs Tube; afterwards exhauſt the Receiver as much as you can, and when no Air is left in it, you may then pull the Piſton of the Syringe quite up, without ſucking any Mercury up the Glaſs Tube: This ſhews that all the Phœnomena of Suction and Pumps are not owing to an Abhorrence of a *Vacuum* in Nature, but to a Preſſure in the Air.

26. Take a Lamp Cupping-glaſs, and ſet it on the Pump with a Receiver (that has a ſmall Hole in the Top) over it, then exhauſt the Receiver, and the Air in the Cupping-glaſs will expand itſelf and come out; then let the Air in on a ſudden, by taking off your Finger which was held at the Top-hole of the Receiver, and the Cupping-glaſs will be faſt, and the Receiver become looſened; put on the Receiver and exhauſt again, and the Cupping-glaſs will be looſe, and the Receiver faſt as at firſt; but you muſt not ſet the Cupping-glaſs over the Hole in the Plate, becauſe then you would exhauſt that and not the Receiver. This Experiment ſhews, that what is commonly called *Suction*, is only the Preſſure of Air, which faſtens the Cupping-glaſs by ſtriking againſt the Outſide of it before it can get under it.

27. Take two glaſs Bubble Fountains, (*i. e.* glaſs Bubbles of about two Inches Diameter, with a Tube ſo cemented to the Neck of each of them, that one End almoſt touches the Bubble on the Inſide, and the other End, without the Bubble is almoſt all ſhut up but a ſmall Pin Hole) and invert the one into a little Jar of Water, and the other into a little Jar of Mercury; then ſetting all under a Receiver, upon exhauſting it, the Air, by its Expanſion, comes out of the Fountains through the Water and Mercury; as you let in the Air again, it will force up thoſe Fluids into their reſpective Fountains; which being afterwards ſet with the right End upwards in a tall Receiver, will, upon exhauſting it, make Jets of Water and Mercury by the Spring of the Air, above the Mercury or Water in the Bubbles. *N. B.* You muſt not quite exhauſt the firſt Receiver, leſt too much Mercury or Water ſhould be forced into the Fountain.

28. Take a common Barometer Tube, and fill it with Mercury, and invert it in a little Mercury in a Cup or Jar, then ſet it on the Air Pump, and ſet a Receiver over it open at the Top, then lay a wet Leather on the Top of the Glaſs, and take the large Tube (mentioned in the 4th Experiment) with a Cap and Plate cemented on at the one End,

hermetically ſealed on the other, and put it over the Tube with the Mercury, ſo as to be tight with the Receiver; then begin to exhauſt, and the Mercury in the inner Tube will come down in the ſame Proportion as that in the Gage riſes. If your Pump be tight, you may bring it quite down ſo as to be even with the Surface of the other Mercury; then let in the Air very gently, for if you let it in too faſt, you will endanger breaking the Tube, and ſpoil the Experiment.

29. Take two Pieces of Marble, Planes of Glaſs, or Plates of Braſs well poliſhed, then put a little Oil between them, to keep them from admitting the Air between them, and the loweſt Marble will ſtick ſo faſt to the uppermoſt as to hold a conſiderable Weight; then take a Receiver, open at both Ends, and ſet it on the Air Pump, lay a wet Leather on the Top thereof, and take the braſs Plate, with the Collar, Leathers, and Slip-wire, and ſcrew on a Hook; put the Plate upon the Top of the Glaſs, and hang on the Marbles or Plates on the Hook within the Glaſs; then exhauſt the Receiver, and they will drop aſunder; then let down the upper Piece juſt upon the under, and let in the Air on a ſudden, and then the Marbles, when taken out of the Glaſs, will bear more Weight than before when you had put them together with your Hands. The ſame Receiver, Plate, and Wire, will ſerve, as uſed in the 22d Experiment.

30. Take a ſmall Syringe with a leaden Weight at the Bottom, then take a tall Glaſs and ſet it on the Air Pump, and lay a wet Leather on the Mouth thereof, then take the three Inch Plate, with the Collar of Leathers and Wire, and ſcrew the End of the Wire into the Top of the Syringe, which put within the Glaſs with the lead Weight at the Bottom; then exhauſt the Glaſs, and the Weight will come down with the Barrel of the Syringe, becauſe the Air being taken out of the Receiver, which preſs'd upon the Piſton of the Syringe, the Weight becomes too heavy for the Friction of the Piſton's Leather againſt the Sides of the Syringe, and not being reſiſted by the Air, it muſt by Conſequence come down; let in the Air, and the Weight riſing again, will return to its former State.

Miſcellaneous Experiments.

31. Take a middle-ſiz'd Glaſs, wipe it well, and ſet it on the Plate, then begin to exhauſt a little, and hold a Candle on the other Side, and you will ſee a Halo about the Candle, or ſeveral Colours in the Glaſs, which will be ſeen only when the Glaſs is firſt exhauſting, for when the Glaſs is quite exhauſted the Colours are all loſt. But if you let in the Air and begin to exhauſt, you will ſee the Colours as before, which may be repeated as often as you pleaſe.

32. Set your Bell upon the Plate of your Pump, and cover it with a Receiver of the middle Size, then ſhake the Pump, and take Notice of the Sound of the Bell; exhauſt the Air, and you will not hear the Sound *in vacuo*, though the Clapper be made to ſtrike the Side of the Bell.

33. Set a lighted Candle in your talleſt Receiver, and a few Exſuctions will cauſe the Candle to go out; the Smoke of the Candle will then lie at the Top of the Receiver, but when you have pumped out all the Air, it will fall down. This ſhews that the Smoke does not riſe, becauſe it is poſitively light, but only becauſe it was ſpecifically lighter (or leſs heavy) than Air.

34. A Piece of lighted Charcoal fixed by a Wire to the braſs Hook belonging to the Collar of Leathers, ſo as to ſuſpend it in a Receiver, will go out *in vacuo*.

35. When you would fire Gunpowder *in vacuo*, take a Gallipot, and inverting it, ſet the Gunpowder Iron (that you have with the Pump) upon the Pot, having firſt made it red hot; cover it with your Gunpowder Receiver (which muſt be firſt warmed by Degrees, leſt the Heat of the Iron ſhould crack it) and having exhauſted it, by moving the Slip-wire up and down, you will let fall a ſmall Quantity of Gunpowder upon the hot Iron, where it will fire Corn by Corn; when you let in the Air again, let it be by little and little, leſt you crack the Receiver. *N. B.* After every Exploſion exhauſt the Receiver, becauſe the Gunpowder generates Air, and might burſt the Receiver.

36. If you would preſerve Fruit, Flowers, or any thing elſe *in vacuo*, fix the Plate of your Tranſferrer by its Hook to the Pump-plate, on which you may lay your Fruit in a Jar; cover the Hole with a Receiver that ſtands on the Tranſferrer with a wet Leather under it; after Exhauſtion take off the Receiver, as is mention'd in the 24th Experiment, and keep it as long as you will, having ſcrewed the Cock to its wooden Foot; if you would prevent the leaſt Air from coming in, put the whole Machine under Water and keep it ſo.

37. Take the Steel Plate which is fixed on the Spindle, with the Nuts belonging to the Machine for the Attrition of Bodies *in vacuo*, and having ſcrewed the braſs Springs with the Flint tied to it, ſo as to preſs the Edge of it againſt the Steel, let the Spindle paſs through the Collar of Leathers of the Plate which covers the large Receiver that is ſet over the Flint and Steel; put the Pulley and Spring upon the Spindle, and ſcrew down the Board, with the Center Hole croſs the Pillars; then turn the great Wheel, to give a Motion to the Steel Plate againſt the Flint, which will produce many Sparks; but as you exhauſt the Receiver the Sparks will diminiſh and quite vaniſh when all the Air is drawn out, tho' the ſame violent Motion is continued; ſee the Plate which repreſents the braſs Springs with the Flint fixed to them, and the Hole to ſcrew in the Center Plate for the Spindle to turn upon. The ſame Figure alſo repreſents the Spindle and Pulley, with the Steel Plate and Nuts in the Middle.

38. Soap'd Water will riſe into large Bubbles *in vacuo*, upon which you will ſee ſeveral Colours ſucceed each other; and the Skin of Water, when extreamly thin, will be black.

39. With a Piece of ſolid *Phoſphorus* write upon a Paper, and laying it upon the Plate of the Pump, with another Paper under, (leſt you wet the firſt Paper) draw out the Air, and the *Phoſphorus* will brighten by Degrees, and at laſt throw up a lucid Cloud to the Top of the Receiver. *N. B.* The Room muſt be dark for ſuch Kind of Experiments.

40. If you wet the Paper by Patches on which you have drawn Lines with *Phoſphorus*, inſtead of a Cloud it will give Flaſhes *in vacuo*.

41. Take the Receiver uſed for the Guinea and Feather Experiment, and to the braſs Plate uſed to cover it, ſcrew a large Cupping-glaſs with a Tube cemented to its Neck, with a fine Hole in it, ſo as to make a Funnel, and having ſtopped the Hole of the Neck of the ſaid Cupping-glaſs with a wooden Plug, fill it with Mercury. Under the Receiver have another tall one of an arch'd Figure, without a Knot at Top, as in the Plate.

Then having drawn out the Air from both Glaſſes, take out the wooden Plug, and the Weight of the external Air will force the Mercury with a Shower upon the inward Glaſs, ſo as to produce a great Light in a dark Room, if the Mercury be fine, and the Weather very dry, otherwiſe the Experiment will not ſucceed.

42. Having cemented an open Tube ending in a Point to a braſs Stop-cock, put it through the braſs Plate that covers an open Receiver, ſo that the Tube may reach down half an Inch below the Surface of a Pound or two of Mercury, in a Glaſs Jar under the Receiver; ſhut the Cock, then exhauſt the Receiver, and then opening the Cock, the Air will ruſh in through the Mercury, ſo as to throw it in little Balls all over the Glaſs, and produce a fiery Shower viſible in a dark Room, if the Weather be dry. See the Plate.

43. Having exhauſted a Receiver, let in the Air again at the Top through an iron Tube, (or braſs Tube whoſe End is ſcrewed to an iron one) ſo that it may paſs through the Flame of Charcoal before it goes into the Receiver; and when the Receiver is full of that Air, lift up the Cover of the Receiver, and letting down an Animal into the Glaſs, you will find that this infected Air will kill him immediately. If the End of the Tube be thruſt into the Hole of a ſolid Piece of red hot Braſs, which is not perforated quite through, the Air that muſt come into the Tube, will in its Way carry along with it the Effluvia of the Braſs, which will poiſon the Air, but not ſo much as before, an Animal being longer a dying in this, than in the laſt Medium. If a Candle be let down into the Receiver, when filled with this Air, it will go out, but purge the Air as far as it goes; for you may let it down the ſecond time lower than the firſt, and ſo on till the whole Air be purified.

44. To an equal (but ſmall) Quantity of Oil of Vitriol, Oil of Tartar *per Deliquium*, and Oil of Cloves, put two or three ſmall Pieces of *Phoſphorus*, and this Mixture will take Fire in the open Air; but the Addition of a little common Water will put it out. This Preparation will not only ſhine, but boil up into a Flame in the exhauſted Receiver.

45. If you would weigh any Quantity of Air, take a pretty large copper or glaſs Ball, ſuch as Fountains (by Compreſſion of Air upon Water) are made of, and having by Means of a Cock fixed it to the Female Screw in the Plate of your Air-pump, exhauſt it, ſhut the Cock, and having taken off this exhauſted Ball, hang it at one End of the Beam of a Pair of Scales; counterpoize it at the other End, then let in the Air into the Ball by opening the Cock, and the Ball will preponderate; ſo much Weight being required to reſtore the Equilibrium, as anſwers to the Weight of the Air contained in the Ball above-mentioned.

46. To the Slip-wire of the Collar of Leathers, at the Top of the Receiver, fix a Piece of Cork with ſeveral ſmall Tubes going through it, and having ſet a Jar with colour'd Water in it under the Receiver, pump out the Air; then by puſhing down the Slip-wire, plunge the Ends of the ſmall Tubes into the colour'd Water, and it will riſe as high in thoſe Tubes as it does in open Air.

47. Take a Veſſel of Braſs like a Funnel, or truncated Cone, open at both Ends, made ſo that the Hole at one End is not above half an Inch Diameter, and the other End almoſt four Inches; ſet this truncated Cone upon the Receiver with the ſmall Hole upwards, and having laid a Piece of flat Window Glaſs upon it, exhauſt the Air, and the Glaſs will not break; let in the Air again, and laying the ſame Piece of Glaſs upon the larger Orifice of the braſs Veſſel, as ſoon as you have drawn out the Air, it will break; which ſhews, that the Preſſure of the Air is proportionable to the Surface on which it preſſes. The braſs truncated Cone is ſhewn by the Plate; which ſee.

48. Flies will not die, but be unable to fly *in vacuo*.

49. Take a Piece of Wood with a little Hollow in it, like a round Trencher, and weigh it; then having laid ſome Mercury in the ſaid Hollow, cover it with a Receiver, and when you have drawn out and again let in the Air, you will find the Wood much heavier than it was, the Air having preſſed a great deal of Mercury into the Pores of the Wood.

Innate AIR, [with *Anatomiſts*;] is ſuppoſed to be a fine aereal Subſtance incloſed in the Labyrinth of the inward Ear, and ſo miniſters to the due Conveyance of the Sound to the Senſory.

AIRY *Meteors*: See *Meteors*.

AIRY *Triplicity*, [*Aſtrology*,] the Signs *Gemini*, *Libra*, and *Aquarius*.

AISIAMENTA, [in *Law*,] Eaſements or Conveniencies, including any Liberty of Paſſage, open Way, Water-Courſe, *&c.* for the Eaſe and Conveniency of any Tenant of a Houſe or Land, *&c.*

AISLE, [in *Heraldry*,] ſignifies winged, or having Wings.

AISTHETERIUM, Αἰσθητήριον, of *αἰσθάνομαι*, *Gr. to perceive*,] the common Senſory, which *Cartes* would have placed in the *Glandula pinealis*, but is now generally ſuppoſed to be about the Beginning of the *Medulla oblongata* in the *Corpus ſtriatum*.

AJUTAGE, is a Spout for a *Jet d'Eau* in any Fountain. Mr. *Mariott* affirms, that an even poliſhed round Hole in the End of the Pipe, or Tube, will give an higher Jet than either a Cylindrical or Conical Ajutage; but of thoſe the latter is the beſt. Here follows ſome Proportions of Ajutages and their Tubes.

1. If the Heights of two Tubes continually full of Water be unequal, and the Adjutages likewiſe unequal, then the Quantities of Water ſpouting out through them in the ſame Time, are in the Ratio compounded of the ſimple Ratio of the Ajutages, and the ſubduplicate Ratio of the Heights.

2. If the Heights of two Tubes continually full of Water be equal, the Water will ſpout out thro' Ajutages, any how unequal, with the ſame Velocities.

3. If the Heights of Tubes continually full of Water, and their Adjutages be unequal, the Velocities of the Water ſpouting out are in the ſubduplicate Ratio of the Altitudes.

4. Mr. *Mariott* found by Experience, that Water ſpouting out through Adjutages, ſituate in the ſame horizontal Line, and made in the ſame Tube of 2, 4, 6, 10, 12, *&c.* Lines in Diameter, would ſpout higher through the leſſer Ajutages, than thro' the greater ones.

ALA, [*Anatomy*,] a Term uſed for the ſeveral Parts of the Body, which bear ſome Reſemblance to the Figure of a Wing. *L.*

ALA, [in *Botany*,] ſignifies the Angle (which generally is acute, and never greater than a Right one on the Foot Stalk of Plants, and is always tending upwards) that either the Leaves or the Foot Stalks of Leaves make with the Stalk, or with any

Branch of the Plant. Sometimes alſo it is taken for a little Branch, making an Angle after that Manner with the Stalk.

ALABASTRA, in a *Plant*, are thoſe little green Leaves which compaſs in the Bottom of the Flower.

ALÆ, [*Anatomy*,] the Lobes of the Liver and the *Nymphæ*; alſo the ſpongeous Bodies in the *Pudendum muliebre*; alſo the Cartilages of the Noſe which form the Noſtrils.

ALAMIRE, the loweſt Note but one in the three Septenaries of Muſick, or the Gamut.

ALARM *Poſt*, is the Ground appointed to each Regiment by the Quarter-Maſter-General, for them to march to in Caſe of an Alarm; in a Garriſon it is the Place where every Regiment is ordered to draw up in on all Occaſions.

ALBADARIA, [*Anatomy*,] the largeſt Bone of the Great-Toe, at the uppermoſt Part of the *Metatarſus*. *Arab.*

ALBA FIRMA, in *Land*, is an Annual Rent in Money, payable to the Chief or Lord of any Hundred; and *Spelman* ſaith, 'tis called *Alba*, becauſe it is not paid according to the Cuſtom of old Times, in Corn, which was called *Blackmail*, but in Silver, or, as they ſay now in ſome Parts of *England*, in *White Money*. There are Tenures of this Nature in *Weſtmorland*, 2 *Part Inſtitut. Fol.* 10.

ALBA PITUITA, the ſame with *Leuco-phlegmatia*.

ALBUGINEA *Oculi*, is a very thin white Coat or Tunic of the Eye, adhering to the *Cornea*, extending itſelf beyond the *Sclerotick*, even to the Circle of the *Iris*, but leaves a Hole forward for the Opening of the Apple of the Eye. See *Tunica Adnata*: It is by ſome Writers called *Tunica Conjunctiva*.

ALBUGINEA TESTIS, is the White Membrane immediately involving the *Teſtes* or *Teſticles*.

ALBUGO, the *Pin* and *Web*, is a white Speck in the Horney Tunicle of the Eye, which hinders the Sight, and uſually follows an Inflammation, Wound or Ulcer of that Part. Sometimes it is taken for the *Album Oculi*, or White of the Eye; being that Part where the *Tunica adnata*, or *Albuginea* adheres to the *Sclerotica*.

ALBULA. This Word is uſed ſometimes for a Spot in the Eye, and then ſeems to be the ſame with *Albugo*: But in the Plural *Albulæ*, ſignifies ſuch very aſtringent Mineral Waters as have a great deal of Allom in them, and are chiefly uſed externally for cleanſing and healing of Wounds and Ulcers. *L.*

ALBUM *Oculi*, ſometimes is taken for the ſame with *Albugo*: But by *Galen* and *Hippocrates* is uſed for that Tunic of the Eye which is uſually called the *Tunica adnata*; and by ſome Writers *Albuginea Oculi*: Which ſee under thoſe Words.

ALCHAICKS, are a Sort of Verſes conſiſting of two *Dactyls* and two *Trochees*, as ſome will have it; but *Fabricius* ſaith they conſiſt of five Feet, of which the firſt is a *Spondee* or *Iambick*, the ſecond an *Iambick*, the third a long Syllable, the fourth a *Dactyle*, the fifth a *Dactyle* or *Amphimacer*; as theſe of *Horace*.

Vides ut alta ſtat nive candidum
Soracte, nec jam ſuſtineant onus.

ALCHYMY, [of *Al*, an *Arabick* Particle, and χυμία, or χῦμα of χύω, *Gr. to melt Metals*,] that ſublimer Part of *Chymiſtry* which teaches the Tranſmutation of Metals, and the *Philoſopher's* Stone; according to the Cant of the *Adeptiſts*, who amuſe the ignorant and unthinking with hard Words and Nonſenſe: For, were it not for the *Arabick* Particle *Al*, which they will needs have to be of wonderful Virtue here, the Word would ſignify no more than *Chymiſtry*; whoſe Derivation ſee under that Word. This Study of *Alchymy* hath been rightly defined to be *Ars ſine Arte, cujus principium eſt mentire, medium laborare, & finis mendicare*: That is, an Art without Art, which begins with Lying, is continued with Toil and Labour, and at laſt ends in Beggery. And ſo poor *Penotus* found it, who after he had ſpent his whole Life and Fortune in this vain Study, died at laſt in an Almſ-Houſe at *Yverdon* in *Switzerland*; and uſed to ſay, he would recommend the Study of *Alchymy* to a mortal Enemy, whom he did not dare openly to attack.

ALCOCHODON, [*Aſtrology*,] *i. e.* the Giver of Life or Years: The Planet which bears Rule in the principal Places of an Aſtrological Figure when a Perſon is born, ſo that his Life may be expected longer or ſhorter, according to the Station, *&c.* of this Planet.

ALCOHOL, ALCAHOL, a Term uſed by the *Chymiſts*, both for a very fine or impalpable Powder, and alſo for a very pure Spirit well rectified or dephlegmated. Thus the higheſt rectify'd Spirit of Wine is called *Alcohol Vini*. Hence to *alcoholize* any thing, with them ſignifies to ſubtilize; as when any thing is beaten to a very fine Powder, *&c.*

How to make a tolerable true *Alcohol*, or pure Spirit of Wine, ſee in *Alcalizate Spirit of Wine*.

ALCOHOLIZATION, the reducing any Subſtance into an *Alcohol*.

ALCOLA, is ſometimes uſed for *Aptha*, and ſometimes ſignifies a tartarous Sediment in Urine, and from hence Urine is ſometimes called *Alcolita*.

ALCOVE, [in *Architecture*,] is a Part of a Chamber ſeparated by an *Eſtrade*, or Partition made by Columns, and other correſponding Ornaments, in which is placed a Bed of State, or ſometimes Seats to entertain Company.

ALDEBARAN, an *Arabian* Name for a fixed Star of the firſt Magnitude, ſituate in the Head of the Conſtellation called the *Bull*, and therefore is uſually named the *Bull's Eye*.

ALE-TASTER, is an Officer appointed and ſworn in every Court-Leet, to look that there be a due Size and Goodneſs of Bread, Ale, and Beer, ſold within the Juriſdiction of the Leet.

ALEMBICK, [of *Al*, an *Arabick* Particle, and Ἄμβιξ, *Gr.*] is a Chymical Inſtrument uſed in Diſtilling: It has the Shape of an Helmet, concave within, and convex without; and towards the Bottom is placed a Beak or Noſe about a Foot and a half long, by which the Vapours deſcend; ſometimes they are made without a Noſe, but then they are rather circulatory Veſſels, and the Head is called a *Blind-head*: They are made uſually of Copper tinn'd within-ſide; and often of Glaſs.

ALEOPHANGINÆ *Pillulæ*, are purging Pills compoſed of *Aloes* and ſeveral Spices.

ALER SANS JOUR, (a *Law Term*) ſignifying to be finally diſmiſs'd the Court, becauſe there is no further Day aſſign'd for Appearance.

ALEXIPHARMICK *Medicines*, [Ἀλεξιφάρμακος, of ἀλέξω, *to expel*, and φάρμακον, *Gr. Poiſon*,] are ſuch as are uſed as Antidotes againſt Poiſon, or any infectious Diſeaſe ; or to raiſe or ſtrengthen the decayed or drooping Spirits in malignant Diſtempers.

ALEXIPYRETUM, [Ἀλεξιπύρετον, of ἀλέξω and πυρετός, *Gr.*] a Fever.

ALEXITERICAL, { of ἀλέξω and δηλητήριον,
ALEXITERICK, } *Gr. Poiſon*,] the ſame with *Alexipharmick*.

ALEXITERIUM, a Preſervative againſt Poiſon.

ALFRIDARY, [*Aſtrology*,] a temporary Power they imagine the Planets have over the Life of any Perſon.

ALGAROT, [in *Chymiſtry*,] ſignifies a ſtrong Emetick and Cathartick Powder, the ſame as *Mercurius Vitæ*, being made of Butter of Antimony precipitated into a white Powder, by being waſhed or diluted in a large Quantity of warm Water.

ALGEBRA ; the wonderful *Analytick Art*, or the Art of Equation ; in *Arabick* it is called *Al-giabr W'al-mokabala*, from the former of which Words we call it *Algebra* ; and it may be render'd, either the *Art of Reſtitution and Compariſon*, or *the Art of Reſolution and Equation*. *Lucas de Burgo*, the moſt ancient *European* Writer of *Algebra* we have, defines it *Reſtaurationis & Oppoſitionis Regula*.

The *Italians* give it the Name of *Regula Rei & Cenſus* ; that is, *the Rule of the Root and the Square*, becauſe they call the Root *Res*, and the Square *Cenſus* ; and from *Coſa* in the *Italian* Language, for from *Res*, or the Root, comes the Word *Coſſick*: For ſome Writers call the *Powers* of Numbers, as the *Root*, the *Square*, *Cube*, &c. *Coſſick Numbers*.

Cardan calls it, and that very juſtly, *Ars magna*, the *great Art* ; following therein *Lucas de Burgo*, who ſtiles it in *Italian*, *l' Arte maggiore*.

It was certainly of old in Uſe amongſt the *Grecians*, but purpoſely concealed as a very great Secret. We have ſome Examples of it in *Euclid*, or at leaſt in *Theon* upon *Euclid*, who tell us, it was firſt communicated by *Plato*: There are alſo Inſtances of this Art in *Pappus* ; and we find the Effects of it plainly in *Archimedes*, *Apollonius*, and ſome others, though ſtudiouſly covered and diſguiſed. The firſt Book amongſt the *Greeks*, and, I believe, the only one that treats profeſſedly of *Algebra*, is that of *Diophantus*, publiſhed at firſt in *Latin* by *Xylander*, afterwards in *Greek* and *Latin* by *Bachet*, with ſome things added of his own ; and ſince him by Mr. *Fermat*, with ſome Additions of his likewiſe. But it certainly was in Uſe among the *Arabs* more anciently than among the *Greeks* ; and they are ſuppoſed to have had it from the *Perſians*, and the *Perſians* from the *Indians*. Thence, that is, from the *Arabs*, the *Moors*, and *Saracens*, brought it into *Spain*, from whence it came into *England* ; and that before we knew any thing of *Diophantus*. The Uſe of the Numeral Figures, Mathematick Learning, and all our old Aſtronomy, came to us likewiſe the ſame Way from the ſame Original, and about the ſame Time.

The firſt *European* Writer of *Algebra* (as was hinted above) is *Lucas Pacciolus*, or *Lucas de Burgo*, a Minorite Frier: His Book is in *Italian*, printed at *Venice*, 1494. He makes mention of one *Leonardus Piſanus*, and ſeveral others, from whom he learn'd it, but we have none of their Writings. He ſays, this Art came originally to us from the *Arabs*, and makes no Mention of *Diophantus*, who therefore, 'tis probable, was not yet known here. His *Algebra* goes no farther than Quadratick Equations.

Next came out *Stiphelius*, a good Author, but he alſo went on beyond Quadraticks.

But *Scipio Ferreus*, *Cardan*, *Tartalea*, and ſome others, proceeded to give a Solution of ſome Cubick Equations.

After this *Bombelli* went a little farther, and ſhewed how to reſolve a Biquadratick Equation into two Quadratick ones, by the Means of a Cubick.

Then, in the laſt Century, appeared *Nonnius* (*Nunnez* in *Spaniſh*) *Ramus*, *Schonerus*, *Salignacus*, *Clavius*, &c. who wrote on this Subject in various Ways, but generally went no farther than Quadratick Equations.

About this Time out came *Diophantus*, whoſe Method differs much from that of the *Arabs*, which others had hitherto followed.

All this while, the known Quantities in any Equation, were deſigned only by the Numerical Letters, and there were no Symbols nor Marks but for thoſe that were unknown or ſought.

But then came *Vieta*, *A. D.* 1590, and introduced what he called his *Specious Arithmetick* ; which is a Way of giving Marks or Symbols to all the Quantities, both known and unknown ; whereby a very ſhort and conſpicuous Way of *Notation* was gained, the whole Operation expoſed always to the Eye in a ſhort *Synopſis*, and many Diſcoveries were made in *Algebra*, not before taken Notice of.

Vieta alſo introduced the *Numeral Exegeſis* of affected Equations, ſhewing how to extract their Roots in Numbers. And in the Denomination of the Powers of Numbers, he follows *Diophantus*, and not the *Arabian* Manner uſed by others.

The incomparable Mr. *Oughtred* followed, and mightily improved the ſpecious *Algebra* of *Vieta*, in his *Clavis Mathematica*, firſt publiſhed in 1631. He alſo affecting Brevity (which indeed he was a perfect Maſter of, being ſhort, but not obſcure) invented many compendious Characters or Ligatures to note the *Sums*, *Differences*, *Rectangles*, *Squares*, *Cubes*, and their *Sum*, *Difference*, &c. by which Means his little Book contains more excellent and uſeful Geometry, than many other large Volumes. *Oughtred*, in his *Clavis*, uſually contents himſelf with the Solution of Quadraticks, rarely proceeding to thoſe of higher Powers, becauſe he deſigned it as an Introduction to *Algebra* only.

The famous Mr. *Harriott* was cotemporary with *Oughtred*, but died before him ; he left many good things behind him, of which nothing is yet publiſhed but his *Analyticè* or *Algebra*, which Mr. *Warner* printed *A. D.* 1631. From this great Man did *Des Cartes* borrow, not to ſay ſteal, all the famous things in his *Geometry*, which are purely Algebraical, as any one may ſee, that will compare their Methods together : For 'tis impoſſible but one muſt be copied after the other. But the Geometry of *Des Cartes* was not publiſhed in *French* till the Year 1637, and not in *Latin* till the Year 1649. Therefore he muſt have ſeen and copied *Harriott*'s Book.

Mr. *Harriott* did wonderfully improve (in this Treatiſe) that which is purely *Algebra*, in the following Reſpects, and many others which I might mention.

1. He brought in ſmall Letters inſtead of the Capitals uſed by *Vieta* and *Oughtred*.

2. He waved the uncouth Terms of *Quadrato-Cube*, *Surſolid*, &c. explaining the Power plainly to the Eye, by only repeating the Root as often as the Index of the Power.

3. He ſhewed the true Original and Conſtitution of all Equations, by putting all the Equation over to one Side, and thereby making the whole equal to Nothing; whereby alſo he determined the Number of Roots, which he ſhews are in Number, ſuch as the Index of the higheſt Powers in the Equation.

4. He diſcovers the true Conſtruction of the abſolute Number (the *Homogeneum Comparationis*) in a quadratick or ſuperior Equation; ſhewing it to be the Product of the continual Multiplication of all the Roots.

5. The ſame he doth alſo by the Co-efficients.

6. He ſhews the Way to multiply the unknown Roots of an Equation according to any Proportion aſſigned, thereby freeing the Co-efficients from Fractions and Surds.

7. He ſhews how to reduce the adfected Quadraticks to ſimple Equations, and all adfected Cubicks to a Form eaſily ſolvable, by the Means of deſtroying the ſecond Term in ſuch Equations.

8. He ſhews the Method, (and a very good one 'tis) of ſolving all adfected Quadraticks, by compleating the Square.

9. He mightily alſo improves the *Exegeſis numeroſa* invented by *Vieta.*

All theſe vaſt Improvements, with many more, (which, to avoid Prolixity, I omit) did *Des Cartes* take from *Harriott*, without ever ſo much as naming him, and publiſh'd them as his own. 'Tis true, in his *Geometry* there are Abundance of excellent Things about the Accommodation of *Algebra* to Geometrical Propoſitions, and many very fine Geometrical Effections and Conſtructions; but this was not *Harriott*'s Buſineſs, who kept himſelf up to pure *Algebra* only. As to which *Des Cartes* hath added but one ſingle Rule (and even that is plainly deducible from *Harriott's* Principles) over and above what is in *Harriott*; and that is, the Method of diſſolving a Biquadratick Equation, whoſe ſecond Term is wanting, into two Quadraticks, by Means of a cubick Equation of a plain Root; and this, after all, both *Bombell* and *Vieta* had done before him. And thus leaving the *French* Plagiary, I come next to another of *our* Country Algebraiſts, Dr. *Pell*, who reviſed and altered a Piece of *Algebra* firſt publiſhed in *High Dutch*, *A. D.* 1659, at *Zurich*; and after tranſlated into *Engliſh* by Mr. *Thomas Brancher*, and printed *A. D.* 1688, and called *An Introduction to Algebra*; in which Dr. *Pell* gives us a peculiar Method of his own for applying *Algebra* to Problems of divers Sorts; and introduces a Way of keeping a Regiſter of the whole Proceſs in the Margin. He ſhews alſo there how to judge whether a Problem be fully determined or not, which is by this Rule (as Dr. *Wallis* interprets him): *If the Number of the* Data, *or Things given in any Queſtion, be (independent of each other) fewer than the Things ſought, the Queſtion is not fully determined, but is capable of innumerable Anſwers or Solutions.*

But if the Number of both Data *and* Quæſita *be the ſame, the Queſtion is then determined either to ſome one, or to ſome certain Number of Solutions.*

And when the *Data* are more in Number than the *Quæſita*, ſo many as exceed are always ſuperfluous, and ſometimes, it may be, are contrary to, or inconſiſtent with others, and conſequently render the thing impoſſible.

Dr. *Pell* alſo, beſides the former Characters, introduced this Mark @ for *Involution*, and this *vu* for *Evolution*, as he calls it, *i. e.* for Squaring, Cubing, *&c.* of any Quantity, and for Extracting the Square, Cube, *&c.* Roots out of any Quantity. He makes alſo the Mark : to ſtand for *Diviſion*, and regiſters the ſeveral Steps of the whole Proceſs by Numeral Figures in their Order in the little Column in the Middle; keeping an Account alſo in Symbols of the ſeveral Operations in the Column towards the Left Hand, that ſo you may ſee how any Quantity or Equation in the large Column towards the Right Hand is produced; in which very good Method he is followed by Mr. *Ward*, in his ſmall Treatiſe of *Algebra.*

Algebra is well enough divided into,

1. *Numeral* or *Vulgar*; which was that of the Ancients, and ſerved only to find the Solution of Arithmetical Problems, without any Demonſtration; ſuch as thoſe given us by *Diophantus*, &c.

2. *Specious* or *New*, called ſometimes *Logiſtica Specioſa*, and often *Species* alone; which ſince *Vieta* hath been performed by Letters of the Alphabet: And this Way of Notation is very pleaſing to the Mind, aſſiſting to the Imagination, and eaſy to the Memory. This alſo is no Ways limited, like the former *Algebra*, to any one certain kind of Problems, but ſerves equally for the Inveſtigation and Demonſtration of all Theorems; eſpecially if to thoſe two you add the new Methods of

3. *Fluxions*; a large Account of which you will have under that Word.

Quantities in *Algebra* are conſidered to be either *Poſitive* or *Negative.*

Poſitive, or *Affirmative Quantities*, are thoſe that have a real Value; and *Negative Quantities* are ſuch as have their Value oppoſite to the Affirmative, ſo as to deſtroy an equal Number of Poſitives when added to them. Thus in human Affairs, Poſſeſſions may be called poſitive or affirmative Quantities, and Debts negative ones; and ſo in local Motion, poſitive Quantities are denoted by the Sign (+) Plus, and negative Quantities by the Sign (—) Minus; and when no Sign is prefixed to the Quantity, Plus is underſtood.

When the Sign (+) ſtands between any two or more Quantities, it denotes the Sum of thoſe Quantities, or that they are to be added; but when (—) ſtands between any two Quantities, it denotes the Difference, or that they are to be ſubtracted; thus $a + b$ repreſents the Sum of the Quantities a and b, and a and b the Remainder or Difference when the Quantity b is ſubtracted from the Quantity a.

The Number of Times any Quantity is taken muſt always be prefixed before the Quantity, and that Number is called its Co-efficient; and if no Co-efficient be prefixed, Unity is underſtood: Thus, $7x$ repreſents the Quantity x taken 7 times; alſo $-12ab$ repreſents the Quantity ab to be taken 12 times, that is, whatſoever the Value of $-ab$ is, $-12ab$ is 12 times that Value.

Simple Quantities are thoſe ſingle Letters which repreſent the ſeveral Numbers or Lines in a Problem, or thoſe which are not connected by + or — to any other: Thus, $7a$ and $6 - xx$ are ſimple Quantities.

Compound Quantities are ſuch as are either the Product Sum, or Difference of two or more ſimple Quantities which are connected by the Sign + or —, Thus $a + b$ and $3xy + 4bc$ are compound Quantities, as alſo $3ab - 5xy - 4cd$ and $-3yz + 4ac$ are compound Quantities.

Two or more Quantities immediately joined together, without any Sign between them, denote a Product or Quantity made by the Multiplication of all the Letters together: Thus, ab denotes a Quantity made by the Multiplication of a into b, and axy denotes a Quantity by multiplying a by x, and that Product into y.

Among Quantities multiplying one another, it is to be obſerved, that the Sign (×) or the Word *by* or *into* is made uſe of to denote the Product ſometimes: Thus, $a \times b$ is the ſame with ab; but the chief Uſe of theſe Notes is, when compound Quantities are multiplied together; as if $y - 2b$ were to multiply $x + 3b$, the Way is to draw a Line over each Quantity, and then write them thus: $\overline{y-2b} \times \overline{x\,3\,b}$.

Quantities are ſaid to be of the ſame Degree, when they are repreſented by a Letter or Letters equally repeated thus, xxx and yyy; alſo aaa and bbb, are Quantities of the ſame Degree, but x, xx, $xxxxxxx$, &c. are Quantities of different Degrees, becauſe the Letters repreſenting thoſe three Quantities is oftener repeated in the 2d than firſt, and after in the 3d, than 2d, &c. the different Degrees of the ſame Letter are called the Powers of the Letter: thus, x is called the Root, or firſt Power.

xx the Square, or ſecond Power.
xxx the Cube, or third Power.
$xxxx$ the Biquadrate, or fourth Power.

The Index, or Exponents of the Powers of a Quantity or Quantities, are Numbers ſet upon the Right Hand of the Quantity to which it is an Index, and a little higher than the Quantity, in ſmall or *Italian* Characters.

Thus, a^1, x^2, x^3, x^4, &c. where 1, 2, 3, 4, are the Indexes of the firſt, ſecond, third, &c. Powers of x; alſo thoſe Powers $xxxx\ 4\,xxx\,y + 6\,xx\,yy + 6\,x\,yyy + yyyy$ may with their Indexes be briefly thus expreſſed, $x^4 + 4x^3y + 6x^2y^2 + 6xy^3 + y^4$.

Like or *ſimilar Quantities* are ſuch as are repreſented by the ſame Letter or Letters, and alſo by the ſame Degree or Power of thoſe Letters: Thus, $+6a - 5a$, $+16a$, $-4a$, are all like or ſimilar Quantities, only they have unlike Signs; alſo $5x^3y - 4xy^3 + 12x^3y$ are ſimilar Quantities.

Unlike or *diſſimilar Quantities*, are thoſe which are repreſented by different Letters, or by different Degrees of the ſame Letter.

Thus, $+5a$, $-bb$, $+7x$, $-5y$, are all unlike Quantities; alſo $+6a + 7a^2 + 8a^3$, $-9a^4$, are diſſimilar Quantities, becauſe they are different Powers of the ſame Letter.

This Sign (=) repreſents that the Sum of the ſeveral Quantities ſtanding on the Left Hand of that Sign are equal to thoſe on the Right: hence it is called the Sign of Equality: Thus, $\overline{a+b+c} = \overline{2x+y}$ repreſents that the Sum of the Quantities a, b, and c, are equal to the Sum of the Quantities repreſented by xx and y; alſo the Difference, or Roots of the Quantities on the Left Hand of the Sign of Equality, will be equal to the Difference or Roots of thoſe on the Right Hand, according as their ſeveral Signs repreſent.

When the Sign (÷) ſtands between any two Quantities, it repreſents that the Quantity on the Left Hand of that Sign ſhould be divided by the Quantity on the Right: Thus, $6a \div 2a = 3a$, that is, $6a$ divided by $2a$, the Quotient is equal to $3a$.

This Character ($\surd$) is called a Radical Sign, and ſignifies, that the Square Root of the Number or Quantity is extracted, or to be extracted; but to deſign the Root of a higher Power, the Index of the Power is to be written over the Radical Sign thus, $\sqrt[3]{aaa}$ ſignifies that the Cube Root of aaa is to be extracted; alſo $\sqrt[4]{x^4y^2}$ ſignifies that the Biquadrate Root of $x^4 \cdot y^2$ is to be extracted. Sometimes the Radical Sign belongs to as many of the following Quantities as have a Line drawn over them, as $\sqrt{b+c}$ ſignifies the Square Root of the Sum of the Quantities b and c; likewiſe $r\,\overline{bb-c}$ imports the Square Root of the Remainder when the Quantity c is ſubtracted from the Square Root of the Quantity b.

Again, $d + r\,\overline{bb-a}$: ſignifies that the Quantity a is firſt to be ſubtracted from the Square b, and then the Square Root of the Remainder is to be added to the Quantity d, and theſe are called Univerſal Roots. After the ſame Manner the Univerſal Square Root of $d + r\,bb\,a$ may be expreſſed thus, $\sqrt{d + \sqrt{bb-a}}$.

Four Points ſet in this Form (: :) are always in the Middle of four Geometrical Proportionals; as for Example, theſe four Numbers, 2 : 4 : 6 : 12 are Geometrical Proportionals, and are to be read thus, as 2 is to 4, ſo is 6 to 12; and in any four Numbers in a Geometrical Proportional, it is to be obſerved, that the Product made by the Multiplication of the firſt and laſt Terms, is equal to the Product made of the ſecond and third Terms, thus; 2 × 12 is equal to 24; alſo 4 × 6 is equal to 24.

In like Manner, theſe four Quantities $a : b :: c : d$ are to be read thus; as a is to b, ſo is c to d.

And the ſeveral Operations of *Algebra*, ſuch as *Addition*, *Subtraction*, *Multiplication*, *Diviſion*, *Extraction of Roots*, *Fractions*, *Equations*, &c. you will find Directions how to perform under thoſe ſeveral Words.

ALGEBRA, beſides the Authors mention'd in the Account of this Science under this Word in this Volume, thoſe that pleaſe to have a thorough Inſight into this wonderful and uſeful Art, may conſult the following Authors.

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ALGEBRAICK *Curve*, [in *Geometry*,] is of ſuch a Nature, that its *Abſciſſæ* or intercepted Diameters bear always the ſame Proportion to their reſpective Ordinates. Thus if the Product of any *Abſciſſa* multiplied into one and the ſame determinate Quantity, be always equal to the Square of its correſponding Ordinate; then if that determinate Quantity be called p, the *Abſciſſa* x, and the Ordinate y; the Expreſſion of the Nature of the Curve by way of Equation will be $p x = y y$, where p is the Parameter or *Latus Rectum* of the Figure, and the Curve is the common *Apollonian* Parabola; and becauſe the two indeterminate or flowing Quantities x and y, do here denote ſtrait Lines; therefore the Curve is call'd an *Algebraick* or *Geometrick* Curve. And 'tis plain that the Number of ſuch Curves muſt be infinite, becauſe there may be an Infinity of Proportions or Relations between the *Ordinates* and the *Abſciſſa*.

But when the Nature of any Curve is expreſſed by an Equation, wherein one of the indeterminate or flowing Quantities repreſents a Curve Line; then that Curve is call'd a *Tranſcendental Curve*; and if the Curve which enters the Equation be Geometrical, or a Curve, as they call it, of the firſt Kind or Degree, then the tranſcendent Curve is call'd a Curve of the ſecond Kind or Degree: And when the Curve which enters the Equation repreſents a Curve of the ſecond Kind or Degree, then the *Tranſcendental Curve* is called one of the third Kind; and ſo on infinitely.

ALGENEB, a fix'd Star of the ſecond Magnitude in the Right Side of *Perſeus*, whoſe Longitude is 57 Deg. 17 Min. Latitude 30. 5. Right Aſcenſion 44 Deg. 15 Min.

ALGOL, or *Meduſa*'s *Head*, a fix'd Star of the third Magnitude, in the Conſtellation *Perſeus*, whoſe Longitude is 51. 27. Latitude 22. 22. and Declination 39. 39.

ALGORITHM, ſometimes call'd *Logiſtica numeralis*, is the Sum of the principal Rules of Numeral Computation; of which they commonly reckon five, *Numeration*, *Addition*, *Subtraction*, *Multiplication*, and *Diviſion*; to which may be added *Extraction of Roots*.

ALGORISM, is the practical Operation in the ſeveral Parts of *Specious Arithmetick*, or *Algebra*; and ſometimes the Word is uſed for the Practice of common Arithmetick by the ten numeral Figures.

ALHIDADA, the Label or Ruler which is moveable on the Center of an Aſtrolabe, Quadrant, *&c.* which carries the Sight. It is ſo called by the *Arabian* Writers of Mathematicks, from whence we took and retain ſeveral *Arabick* Terms, as *Azimuth*, *Zenith*, *Nadir*, *Almacanter*, &c.

ALIEN, a Subject born in a Foreign Country, who, by our Common Law, is not capable to inherit Lands in *England*, till Naturalized by Act of Parliament.

ALIENATION, is, in *Law*, making a thing another Man's, or to alter or put the Poſſeſſion of Lands, or other things, from one Man to another; and in ſome Caſes a Man hath Power in himſelf to do ſo, without the Aſſent or Licence of any other, and in ſome not.

ALIFORMES *Muſculi*, *Alares*, *Pterygoides*, are Muſcles ariſing from the Pterygoide Bones, the Proceſs of the *Os cuneiforme*, partly with a nervous Beginning, and partly fleſhy; and ending in the Neck of the lower Jaw, and towards the internal Seat of the Head.

ALIFORMES *Proceſſus*, are the Prominences of the *Os cuneiforme*, from the Fore-part; the ſame with the *Pterygoides*.

ALIMA, [of *α priv.* and λιμὸς, *Gr. Hunger*,] Medicines which either prevent or allay Hunger.

ALIMENT, is whatever ſerves to nouriſh, ſupply the Decays of, and to recruit an animal or vegetable Body.

ALIMENTARY *Duct*, [*Anatomy*,] that Part of the Body through which the Food paſſes from its Reception into the Mouth, to its Exit at the *Anus*, including the *Gula*, Stomach, and Inteſtines; it is ſometimes uſed for the *Thorachick Duct*.

ALIMONY, formerly ſignified Nouriſhment or Maintenance; but in a modern legal Senſe, it is that Portion or Allowance which a married Woman ſues for upon any occaſional Separation from her Husband, wherein ſhe is not charged with Elopement or Adultery. This was recoverable in the Spiritual Court, but now only in Chancery.

ALIQUOT PART of a Number, is ſuch an one as will exactly meaſure it without any Remainder. But an

ALIQUANT PART, is that which cannot meaſure any Number exactly, but that ſome Remainder will be left. Thus 3 is an Aliquot Part of 12, becauſe being taken four times it will juſt meaſure it; but 5 is an Aliquant Part of 12, for being taken twice it falls ſhort, and when taken three times it exceeds 12.

ALKAHEST, one of the canting Terms of the *Alchymiſts*, by which they intend an Univerſal *Menſtruum* that will diſſolve all Manner of Bodies; and by which they pretend to extract the Sulphur of Metals. Some Chymiſts have given this mighty Name to the Tincture or Liquor of *Flints*, which is a Solution of them made (after Calcination) by the Means of Salt of Tartar; and others to the Liquor of *Fixt Nitre*, which is Nitre calcined and fixed, by burning powder'd Coals with it, and at laſt run into a *Deliquium*, by being ſet in a cool Cellar, as Oil of *Tartar per Deliquium* is made. *Van Helmont* calls this Liquor *Fomes Ignis Gehennæ*: He pretends to be Maſter of it himſelf, and Mr. *Boyle* is inclined to believe him. *Helmont* ſaith, it would diſſolve all Bodies, without leaving any *Caput mortuum*, and was as fit for a new Operation, after it had diſſolved one kind of Body, as at firſt; it would diſſolve Metals, Marchaſites, Stones, and even Glaſs itſelf, when finely powder'd.

'Tis found, that the common *Menſtruums*, ſuch as *Aqua Fortis*, *Spirit of Nitre*, &c. when they have once diſſolved any Metal, are render'd incapable by it of any further Service, having the Points or Edges of their *Acids* ſo broken, that they can hardly diſſolve any more of the ſame, or any other Metal. Therefore this immortal *Alkaheſt* had, in this Reſpect, a wonderful Preheminence, if what they relate of it be true. And to ſhew that ſomething of this Nature is poſſible, Mr. *Boyle* ſays, that he diſtill'd a Spirit from Verdigreaſe, which would ſerve more than once as a *Menſtruum* to diſſolve Bodies, or to draw Tinctures, and being drawn off, was ready for the ſame Operation a-new.

ALKALIZATE *Spirit of Wine*; ſo Mr. *Boyle* calls a Spirit of that Liquor diſtilled from Salt of Tartar, or Tartar calcined to Whiteneſs: And by ſo drawing off Spirit of Wine from that Salt, you may get eaſily a pure and rich dephlegmated Spirit, (*viz.* one that will burn all away and fire Gunpowder) after this Manner:

Put about an Inch thick of Tartar calcined white, into a Glaſs as long and ſlender as you can procure, and then put upon it Spirit of Wine that hath been once rectified, to a Finger's Height above the Tartar, and fitting on a Head, draw the Spirit off in a very gentle Heat; or at leaſt ſo much of it as you conclude, or find will come pure, and it will anſwer your Expectation at the firſt Diſtillation. The Tartar being dried and new calcined, will ſerve again for a new Operation. If you cannot procure Tartar, Quicklime, or the Salt of Potaſhes, will do tolerably well. *Eſſay of Unſucceſsfulneſs of Experiments.*

ALKALI, a Chymical Word, ſignifying the fix'd Salt of any Plant; and is ſo call'd, becauſe the Herb called *Kali*, which is a Kind of *Sea-blite*, *Glaſs-wort*, or *Salt-wort*, yields ſuch a Salt in a great Quantity. This fix'd Salt of Plants (which is made by burning the Plant, making a *Lixivium* or Lee of its Aſhes; and after filtrating the Lee, evaporating the Moiſture over a gentle Heat, that the fix'd Salt may remain at the Bottom of the Veſſel) being render'd very porous by the Fire's paſſing ſo often through it in its Calcination, and it may be fixing there ſome of its Eſſential Salt: And becauſe very many of the fiery Particles do alſo ſtick in thoſe Pores, it makes a very great Ebullition or Effervefcenſe when any acid Liquor is mingled with it; and from thence, all Bodies that do, or are ſuppoſed to ferment with Acids, are now always called *Alkalies*, or *Alkaliſate Bodies*; not becauſe they muſt always contain any hidden *Alkali* in them, which ſome Chymiſts aſſert as neceſſary to the Cauſe of Fermentation; but becauſe they are of the Nature of *Alkalies* themſelves, and have their Pores naturally ſo form'd, in ſuch a Proportion, as that they are fitted to be penetrated and put into a violent Motion by the Points of the *Acid* poured upon them. Theſe fix'd Salts of Plants are called *Fix'd Alkalies*: But the volatile Salts of Vegetables, becauſe they will ferment with Acids, are called *Volatile Alkalies.*

ALKALIZATION, a reducing or turning into *Alkali.*

ALKERMES, in *Pharmacy*, is a Confection deſcribed in the *Diſpenſatory*, and ſold in the Shops, and ſo called from the *Arabick* Particle *Al* and *Kermes*, which are *Red* or *Scarlet Grains*, the chief Ingredient in the Confection.

ALLANTOIS *or* ALLANTOIDES, is the Urinary Tunick placed betwixt the *Amnion* and the *Chorion*, which by the Navel and *Urachus* (or Paſſage by which the Urine is convey'd from the Infant in the Womb) receives the Urine that comes out of the Bladder: It's called likewiſe *Farciminalis*, becauſe that in many Brutes it is of the Shape of a Gut-pudding, but in Man, and ſome other few Animals, it is round, and like the thin ſoft Skin which wrappeth the Child in the Womb.

The ingenious and accurate Dr. *Richard Hale*, of *Trinity College* in *Oxford*, in *Philoſ. Tranſact.* N. 271. hath obliged the World with a more perfect Diſcovery of the human *Allantois*, and aſſign'd the Reaſons why thoſe who believed its Exiſtence had not before fully found it out; giving alſo an Anſwer to the Objections of thoſe, who even ſtill deny its Reality.

ALLEGATION, is the Citation or Quotation of any Authority, Book, &c. to make good any Point or Aſſertion. *L.*

ALLEGORY, ['Αλληγορία, of ἄλλος, *another*, and ἀγορεύω, *Gr. I ſay,*] is a Figure in Rhetorick, conſiſting of one continual Metaphor, carried on through the whole Diſcourſe; or it is a Series and Continuation of Metaphors, as that Allegory in *Horace*, *Lib.* 1. *Ode* 14.

O Navis referent in Mare, te novi fluctus.

where by the *Ship* is meant the *Commonwealth*, by the *Waves* the *Civil War*, by the *Port Peace* and *Concord*, by the *Oars Soldiers*, and by the *Mariners Magiſtrates.*

ALLEGIANTIA, is the natural and ſworn Allegiance, or legal Obedience, which every Subject bears to his Prince.

ALLEGIARE, is to juſtify and clear himſelf by Courſe of Law, of the Crime objected to him.

ALLEMANDE, is a Kind of grave ſolemn Muſick, where the Meaſure is full, and the Movement ſlow.

ALLIANCE, properly is a Connection of two Perſons, or two Families together by Marriage; but it is often extended in a larger Senſe, ſignifying the Leagues, Unions and Treaties, made between Princes, &c.

ALLIGATION, is a Rule in *Arithmetick*, (ſo called from the Numbers being bound or connected together by circular Lines) relating to the Mixture of Merchandizes; as Corn, Wine, Metals, Medicines, &c. one with another; and to the Proportion of the Ingredients in any Quantity of, and the Price of ſuch a Mixture. 'Tis diſtinguiſhed into two Kinds, *viz. Alligation Medial*, and *Alternate.*

Alligation Medial teaches how to find a Mean in the Price, Quantity or Quality, between the Extreams; and all Caſes in it may be ſolved by theſe Propoſitions and Rules:

1. Having the Quantity of the Ingredients, and the particular Prices, to find the Price or Value of ſome Part of the Mixture.

Rule. Multiply the Ingredients ſeverally by their own Prices, and divide the Sum of thoſe Products by the Sum of the Ingredients, and the Quotient anſwers the Queſtion.

2. Having the particular Prices of the Ingredients, and the Sum paid or received for a Mixture bought or ſold; to find what Quantity of each was bought or ſold.

Rule. Divide the Sum paid or received for the Mixture bought or ſold, by the Sum of the particular Prices, the Quotient gives what was required.

3. Knowing the Ingredients of a Mixture, to augment or diminiſh the Mixture proportionally.

Rule. Sum up the Ingredients; then ſay, As that Sum is to the Augmentation or Diminution, ſo is the Quantity of each Parcel of the Mixture to the Quantity of the Mixture deſired.

4. Knowing the Nature, Quality, or Fineneſs of the ſeveral Ingredients of a Mixture, to find the reſulting Temperament or Fineneſs of the whole.

Rule. Place the ſeveral Quantities of the Mixtures in Rows, againſt which place orderly their ſeveral Qualities of Fineneſs, and multiply each Quantity by its own Quality or Degree of Fineneſs, then as the Sum of all the Quantities is to the Products of all theſe Quantities, ſo is Unity to the Quality or Fineneſs of Mixture.

Example. There are melted and mixed together two Kinds of Silver, one worth 5 *s.* and the other worth 4 *s.* an Ounce, and there were four Ounces of the former, and eight of the latter; what is the Value of an Ounce of the Mixture?

$$\begin{array}{lll} & \textit{Oun.}\quad s. & \qquad\qquad\qquad\qquad s.\ \ d. \\ \text{Silver} & \begin{cases} 4+5=20 \\ 8+4=32 \end{cases} & 12:52::1:\tfrac{52}{12}(=4.\ \ 4 \\ & \overline{12\quad 52} & \end{array}$$

5. Knowing the Quantities of a Mixture, to find the particular Quantities of any Ingredient in any Part of the Mixture.

If the Mixture be compounded of but two Things, then ſay, As the Total of the Ingredients in the Compoſition, is to the Part of the Mixture propoſed: So is the Quantity of the Ingredient propoſed in the whole Compoſition, to the Quantity of the Ingredient in the Part deſired.

But if the Mixture be decompounded, then you muſt repeat your Work upon every Mixture.

6. Knowing the Total of a Mixture, with the Total Value, and the Values of the ſeveral Ingredients mixed, to find the ſeveral Quantities mixed, though unequally.

Rule. Multiply the Total of the Mixture by the leaſt Value; ſubtract the Product from the total Value, and the Remainder is the firſt Dividend: Then take the ſaid leaſt Value from the greateſt valued Ingredient, and the Remainder is the firſt Diviſor. The Quotient of this Diviſion ſhews the Quantity of the higheſt priced Ingredient, the other is the Complement to the whole: And when more Ingredients than two are in the Compoſition, the Diviſors are the ſeveral Remains of the leaſt Value taken from the other. The Dividends are the Remains left upon the Diviſions, till 0 remain there; which will be one Sort of the Number of Ingredients, and this defective Ingredient is to be ſupplied as a Complement; and in Diviſion no more muſt be taken in every Quotient, than that there may remain enough for the other Diviſors, and the laſt to leave nothing remaining.

II. *Alligation Alternate*, ſhews the due Proportion of every Ingredient entring the Mixture, and counter-changes the Places of ſuch Exceſſes or Differences as fall out between the mean Price and the Extreams, aſcribing it to the greater Extream which proceeds from the leſſer, and the contrary.

Rule 1. Let every greater Extream be linked with one leſſer.

2. When either of the Extreams be ſingle, and the other Extreams be plural, the ſingle Extream muſt be linked to all the reſt.

3. If both greater and leſſer Extreams are not ſingle, then they may be linked ſo diverſly, that ſundry Differences may be taken, and Diverſities of Anſwers to the Queſtion, yet all true. But if one of the Extreams be ſingle, there can be but one Anſwer.

4. The Numbers being linked, take the Difference of each Number from the mean or common Price, and place this Difference againſt the Number it is linked to alternately.

5. Every Number linked with more than one, muſt have all the Differences of the Numbers it is linked to ſet againſt it.

6. Thoſe Differences reſolve the Queſtion, when the Price of every of the Ingredients is given without their Quantities, and the Demand be to mix them ſo as to ſell a certain Quantity at a mean Rate.

7. But when the Quantity of one, with the Price of all the Ingredients is given, and the Demand is to know the Quantities of the other Ingredients, then the *Rule of Three* is to be uſed.

8. And when the Price of every Ingredient is given, without any of their Quantities, and the Demand be to make up a certain Quantity to be ſold at a mean Rate, then all the Differences added together ſhall be the firſt Number in the *Rule of Three*; the whole Quantity to be mixed ſhall be the ſecond Number, and each Difference apart the ſeveral third Numbers: And ſo many Sorts mix'd, ſo many Operations of the *Rule of Three.*

9. A Queſtion may be ſo propounded, as both Sorts of *Alligation* is needful to the Reſolution.

Example.

Suppoſe a Mixture of Wine of 119 *Quarts be required, that muſt be made up of theſe ſeveral Prices,* 7 d. 8 d. 14 d. *and* 15 d. *ſo as the whole may be afforded at* 12 d. per *Quart.*

Having link'd 8 to 14, and 7 to 15, and counterchanged their Difference from the common Price 12 *d.* I find the Sum of their Differences to be 14, by which dividing 119, the Quotient is 8 $\frac{7}{14}$ or $8\frac{1}{2}$, or for Conveniency in Operation $\frac{17}{2}$.

$$\begin{array}{rl l} & & \qquad\qquad \textit{Quarts.} \\ 8 & 2 & \frac{17}{2}+2=\frac{34}{2}=17 \\ 14 & 3 & \frac{17}{2}+4=\frac{68}{2}=34 \\ 7 & 4 & \frac{17}{2}+3=\frac{51}{2}=25\frac{1}{2} \\ 15 & 5 & \frac{17}{2}+5=\frac{85}{2}=42\frac{1}{2} \\ \hline & 14 & \qquad\quad 119 \end{array}$$

ALLIOTH, the Name of a Star in the Tail of the *Great Bear*, whoſe Obſervation is much uſed at Sea. The *Elevation of the Pole*, or the *Latitude*, may thus be eaſily found by this Star.

Obſerve when *Allioth* comes to the *Meridian* under the *Pole*, then take the Height of the *Pole-Star* with a Quadrant, and out of that ſubtract 2°. 25. the Diſtance of the *Pole-Star* from the *Pole*, the Remainder is the *Pole*'s Height, or the Latitude.

ALLITERATION, (a Figure in Rhetorick) is a repeating and playing on the ſame Letter.

ALLOCATIONE FACIENDA, is a Writ directed to the Lord Treaſurer and Barons of the *Exchequer*, upon Complaint of ſome Accomptant, commanding them to allow him ſuch Sums as he hath by virtue of his Office lawfully and reaſonably expended.

ALLOCATION, [in *Law*] is an Allowance made upon an Accompt.

ALLODIAL *Lands*, are thoſe for which no Rents, Fines, nor Services are due. Such as *Free-Land.*

ALLODIUM, a Law-Term, ſignifying every Man's own Land, *&c.* which he poſſeſſeth merely in his own Right, without Acknowledgement of any Services, or Payment of any Rent to another, which is a Property in the higheſt Degree.

ALLOY, [*Aloij*, *F.*] is the Proportion of a baſer Metal mingled with a finer or purer; as the Quantity of Copper that is mingled with Gold to make it of a due Hardneſs to be coined into Money, is called its *Alloy* ; and Gold that hath more of this than it ought to have, is ſaid to be of a coarſer or greater *Alloy*. The Proportion of *Alloy* for Gold uſed in our Mints, is about a 12th Part.

ALLUM-*Works*. *Allum* is made of a Stone of a Sea-weed and Urine. The Stone is found in moſt of the Hills between *Scarborough* and the River of *Tees* in the County of *York*, and alſo near *Preſton* in *Lancaſhire* ; it is of a blueiſh Colour, and will cleave like *Corniſh* Slate. The Mine which lies deep in the Earth, and is pretty well moiſten'd with Springs is the beſt. The dry Mine is not good, and too much Moiſture cankers and corrupts the Stone, making it nitrous. In this Mine are found ſeveral Veins of Stone call'd *Doggers*, of the ſame Colour, but not ſo good. Here are found thoſe alſo which are commonly call'd *Snake-Stones*. For the more convenient working of the Mine, which ſometimes lies 20 Yards under the Surface or Cap of the Earth, (which muſt be taken off and barrow'd away) they begin their Work on the Declivity of a Hill, where they may be alſo well furniſhed with Water. They dig down the Mine by Stages, to ſave Carriage, and ſo throw it down near the Places where they calcine it. The Mine, before it is calcin'd, being expos'd to the Air, will moulder into Pieces, and yield a Liquor whereof *Copperas* may be made ; but being calcin'd it's fit for *Allum* ; as long as it continues in the Earth, or in Water, it remains an hard Stone. Sometimes a Liquor will iſſue out of the Side of the Mine, which by the Sun's Heat is turned into natural *Allum*. The Mine is calcin'd with Cynders of *Newcaſtle* Coal, Woods and Furzes ; the Fire made about two Foot and half thick, two Yards broad, and ten Yards long. Betwixt every Fire are Stops made with wet Rubbiſh ; ſo that any one or more of them may be kindled, without Prejudice to the reſt. After there are 8 or 10 Yards Thickneſs of broken Mine laid on this Fewel, and five or ſix of them ſo covered, then they begin to kindle the Fires, and as the Fires riſe towards the Top, they ſtill lay on freſh Mine : So that to what Height you can raiſe the Heap, which is oftentimes about 20 Yards, the Fire without any farther Help of Fewel, will burn to the Top ſtronger than at the firſt kindling, ſo long as any Sulphur remains in the Stones.

In calcining theſe Stones, the Wind many times does Hurt, by forcing the Fire too quickly through the Mine, leaving it black and half burnt ; and in others, burning the Mine too much, leaving it red. But where the Fire paſſes ſoftly and of its own Accord, it leaves the Mine whole, which yields the beſt and greateſt Quantity of Liquor.

The Mine thus calcin'd, is put into Pits of Water ſupported with Frames of Wood, and rammed on all Sides with Clay : They are about 10 Yards long, five broad, and five deep, and ſet with a Current that turneth the Liquor into a Receptory, from whence it is pump'd into another Pit or Mine ; ſo that every Pit of Liquor, before it comes to boiling, is pump'd into four ſeveral Pits of Mine ; and every Pit of Mine is ſteeped in four ſeveral Liquors before it be thrown away, and the laſt Pit being always of the freſh Mine.

This Mine thus ſteeped in each of the ſeveral Liquors 24 Hours, or thereabouts, is of Courſe four Days in paſſing the four ſeveral Pits, from whence the Liquors paſs into the Boiling-Houſe.

The Water, or Virgin Liquor often gains in the firſt Pit two Pound Weight ; in the ſecond it increaſeth to five Pounds, in the third to eight Pounds, and in the laſt Pit, which is always freſh Mine, to twelve Pounds ; and ſo in Proportion according to the Goodneſs of the Mine, and its being well calcin'd. For ſometimes the Liquors paſſing the four ſeveral Pits, will not be increas'd to above ſix or ſeven Pound Weight, and at other Times above 12 Pounds, ſeldom holding a conſtant Weight one Week together : Yet many times Liquor of ſeven or eight Pounds Weight produces more *Allum* than that of 10 or 12 Pounds Weight, either through the Badneſs of the Mine, or its being ill calcin'd, which is the uſual Reaſon.

And if by paſſing the weak Liquor through another Pit of freſh Mine, you bring it to be 10 or 12 Pounds Weight, yet you ſhall make leſs *Allum* with it, than when it was but eight Pounds Weight. For what it gains from the laſt Pit of Mine, will be moſt *Nitre* and *Slam*, which poiſons the good Liquors, and diſorders the whole Houſe till the *Slam* be wrought off.

That which they call *Slam*, is firſt perceived by the Redneſs of the Liquor when it comes from the Pit, occaſioned either by the Badneſs of the Mine, or more uſually its being over or under calcin'd, which in the *Settler* ſinks to the Bottom, and there becomes a muddy Subſtance, and of a dark Colour. That Liquor which comes whiteſt from the Pits is the beſt.

When a Work is firſt begun, they make *Allum* of the Liquor only that comes from the Pits of Mine, without any other Ingredients, and ſo might continue, but that it would ſpend ſo much Liquor as not to quit Coſt.

Kelp is made of a Sea-weed called *Tangle*, ſuch as comes to *London* in Oyſter Barrels. It grows on Rocks by the Sea-ſide, between high and low Water Mark. Being dried, it will burn and run like Pitch ; when cold and hard, 'tis beaten to Aſhes, ſteeped in Water, and the Lees drawn off to two Pounds Weight or thereabouts.

Becauſe the Country People who furniſh the Work with Urine, do ſometimes mingle it with Sea-water, which cannot be diſcovered by Weight, they try it, by putting ſome of it to the boiling Liquor ; for then if the Urine be genuine, it will work like Yeaſt put to Beer or Ale ; but if mingled, it will ſtir no more than ſo much Water.

They obſerve that the beſt Urine for that Purpoſe, is ſuch as comes from poor labouring People, who drink but little ſtrong Drink.

The Boiling Pans are made of Lead, nine Feet long, five broad, and two and half deep, ſet upon Iron Plates about two Inches thick ; which Pans are commonly new caſt, and the Plates repair'd five times in two Years.

When the Work is begun, and *Allum* once made, then they ſave the Liquor which comes from the *Allum*, or wherein it ſhoots, which they call the *Mothers*, with this they fill two Thirds of the Boilers, and put in one Third of the freſh Liquor which comes from the Pits. Being thus fill'd up with cold Liquor, the Fires having been never drawn out, it will boil again in leſs than two Hours Time. And in every two Hours Time the Liquor will waſte four Inches, and the Boilers are filled up again with green Liquor.

The Liquor, if good, in the boiling will be greaſy, as it were, at the Top ; if nitrous, it will be thick, muddy, and red. In boiling 24 Hours it will be 36 Pound Weight. Then is put into the

Boiler about an Hogſhead of the Lees of *Kelp*, of about Two-penny Weight, which will reduce the whole Boiler to about 27 Pound Weight.

If the Liquor be good, as ſoon as the *Kelp Lees* are put into the Boiler, they will work like Yeaſt put to Beer; but if it be nitrous, the *Kelp Lees* will ſtir it but very little; and in that Caſe the Workmen muſt put in more and ſtronger *Lees*.

Preſently after the *Kelp Lees* are put into the Boiler, all the Liquor together is drawn into a *Settler*, as big as the Boiler and made of Lead, in which it ſtands about two Hours, and in that Time moſt of the *Nitre* and *Slam* ſink to the Bottom.

This Separation is made by the Help of the *Kelp Lees*, for when the whole Boiler conſiſts of green Liquor drawn from the Pits, it is of Power ſtrong enough to caſt off the *Slam* and the *Nitre*; but when the *Mothers* are us'd, the *Kelp Lees* are needful to make the ſaid Separation.

Next, the ſaid Liquor is ſcooped out of the *Settler* into a *Cooler*, made of Deal Boards, and rammed with Clay. Into this is put 20 Gallons or more of the Urine, according to the Goodneſs or Badneſs of the Liquor, for when the Liquor is red and nitrous, the more Urine is required.

In the *Cooler*, the Liquor in temperate Weather ſtands four Days; the ſecond Day the *Allum* begins to ſtrike, gather and harden about the Sides, and at the Bottom of the *Cooler*.

If the Liquor ſhould ſtand above four Days, then it would turn to *Copperas*.

The Uſe of the Urine is as well to caſt off the *Slam*, as to keep the *Kelp Lees* from hardening the *Allum* too much.

In hot Weather the Liquor will be a Day longer in cooling, and the *Allum* in gathering, than in temperate Weather. But in Froſt, the *Allum* ſhoots or ſtrikes too ſoon, not giving Time for the *Nitre* and *Slam* to ſink to the Bottom, whereby they are mingled with the *Allum*. This produces double the Quantity, but being foul, it is conſumed in waſhing.

When the Liquor hath ſtood four Days in the *Cooler*, then that call'd *Mother* is ſcooped into a Ciſtern, the *Allum* remaining on the Sides and Bottom, and from thence the *Mothers* are pump'd back into the Boilers again; ſo that every five Days the Liquor is boil'd again, until it evaporate or turn into *Allum* or *Slam*.

The *Allum* taken from the Sides and Bottom of the *Cooler*, is put into a Ciſtern and waſhed with Water, that they uſe for the ſame Purpoſe; being about 12 Pound Weight, after which it is *Roached* as follows.

Being waſhed, it it put into another Pan with a Quantity of Water, where it melts and boils a little; then it is ſcoop'd into a great Cask, where it commonly ſtays ten Days, and is then fit to take down for the Market.

The Liquors are weigh'd by *Troy* Weight; ſo that half a Pint of Liquor muſt weigh more than ſo much Water, by ſo many Penny-weight. *From Phil. Tranſ.* N. 142.

ALLUVION, [in the *Civil Law*,] an Acceſſion or Accretion along the Sea-Shore, or the Banks of large Rivers, by Tempeſts and Inundations. *L.*

ALMACANTERS, an *Arabick* Word ſignifying the ſame with *Parallels of Altitude on the Globe*: Which ſee. Some write it *Almicanterahs*, and others *Almacanterahs*.

ALMACANTERS STAFF, is an Inſtrument uſually made of *Pear-tree* or *Box*, with an Arch only of 15 Degrees, to take Obſervations of the Sun, about the Times of its Riſing and Setting, in order to find the *Amplitude*, and conſequently the Variation of the Compaſs.

ALMAN *Furnace*, or *Almond*, as ſome write it, is a Furnace us'd by *Refiners*, and by them called the *Sweep*: By it all Sorts of Metals are ſeparated from Cynders, Parts of Melting-pots, Teſts, Bricks, and all other harder Bodies, which muſt firſt be beaten to Powder, before they are put into the Furnace.

This Furnace is about ſix Foot high, four wide, and two thick, made of Brick, having a Hole in the Midſt at the Top eight Inches over, and growing narrow towards the Bottom, whereon the Forepart ends in a ſmall Hole environed with a Semicircle of Iron, to keep the melted Metal; about the Middle of the Back there is another Hole to receive the Noſe of a great Pair of Bellows.

When the Furnace is *annealed* with Charcoal, and hot, they throw two or three Shovels of Coal to one of the fore-mention'd powder'd Stuff, and ſo proceed during the whole Work, which continues without Intermiſſion three Days and Nights.

After eight or ten Hours the Metal begins to run: and when the Receiver below is pretty full, they lade it out with an Iron Ladle, and caſt it into *Sows*, in Hollows, or Forms made with Aſhes.

ALMANACK, [is derived by *Verſtegan* Al mon ac, or Almonahꞇ, *Sax. All moon heed*; but *Scaliger* derives it of *Al*, an *Arabick* Particle, and μοναχός, *Gr.* i. e. *the Courſe of the Months*; others derive it of *Al*, *Arabick*, and *mana*, to count or reckon; others again of Al maen-achte, *Teut.* q. d. *an Obſervation of all the Months*,] is an *Ephemeris*, Table, or Kalendar, wherein are the Months, the Days of the Week, the Faſts and Feſtivals, the Changes of the Moon, *&c.*

ALMONDS *of the Throat*, or the *Tonſillæ*, a glandulous Subſtance repreſenting two Kernels placed on each Side of the *Uvula*, at the Root of the Tongue. They are covered with the common Tunick of the Mouth, and have Veins and Arteries from the *Carotydes* and *Jugulars*: They are of a lax and ſpongy Subſtance, having ſeveral *Sinus*'s within them, in which they contain the Liquor of the *Saliva*, which they receive from the Brain, and by diſperſing it to the *Larynx*, *Jaws*, *Tongue*, and *Oeſophagus*, do moiſten and lubricate thoſe Parts. When theſe are ſwelled and inflamed by a Cold, *&c.* they very much ſtreighten the Paſſage of the Throat, and render Swallowing painful and difficult, and help to make what we call a *ſore Throat*, and, as the Country People ſay, the coming down of the Almonds of the Ears.

ALMONER, is an Officer in a King's or Prince's Houſe, whoſe Buſineſs is to diſtribute Alms to the Poor; he hath Forfeiture of all *Deodands* and the Goods of *Felons de ſe*, which he is to diſpoſe of to the Poor. *Terms de Lay* 39.

ALMUCANTERHS, the ſame with *Almacanters*; which ſee.

ALMUTEN, [with *Aſtrologers*,] the Lord of a Figure, or the ſtrongeſt Planet in a Nativity.

ALNAGER, *Aulnager*, properly one that meaſureth Cloth by the Ell, the doing of which is *Alnage*. He is a publick ſworn Officer of the King, who either by himſelf or his Deputy, looks to the Aſſize of Woollen Cloth throughout the Kingdom, and to the Seals for that Purpoſe ordain'd.

dain'd. Now there are three Officers belonging to this Affair, the *Searcher*, the *Meaſurer*, and the *Alnager*; which laſt is now become the Collector of the Subſidy granted to the Crown by ſeveral Statutes.

ALOETICKS, Medicines wherein Aloes is the principal Ingredient.

ALOGOTROPHY, [of ἄλογος, *unreaſonable*, and τροφὴ, *Gr. Food*,] a diſproportionate Nutriment, when one Part of the Body is nouriſhed more or leſs than another

ALOOF, is a Sea Term, ſignifying as much as *keep your Luff*; being a Word of Command from him that *Conns*, to the Man at the Helm, to keep the Ship near the Wind, when ſhe ſails upon a Quarter Wind.

ALOPECY, [ἀλωπεκία, of ἀλωπεξ, *Gr.*] is a ſhedding of the Hair, occaſioned by the Pox, or otherwiſe; ſo called from a *Fox*, ἀλώπηξ, whoſe Urine is ſaid to make Places bald and barren for a Year, as the Scholiaſt on *Callimachus* obſerves; or from a Diſeaſe peculiar to a Fox. It is called likewiſe ὀφίασις, from the Figure, becauſe that the Parts being ſmooth and deſtitute of Hair, look winding like a Serpent. It's common to both theſe Diſtempers that the Hair falls off *areatim*, i. e. *by ſhedding*; whence this Diſeaſe in general is called *Area. Blanchard.*

ALOPEX, is by ſome Writers a Term uſed for the Muſcle *Pſoas*.

ALPHETA, the Name of a Star: See *Lucida Corona.*

ALPHUS,
ALPHOS, } [ἄλφος, *Gr.*] is a cutaneous Diſtemper in which the Skin is rough, and looks here and there as if there were Drops of a white Colour upon it: Some call it *Morphew*; it differs from the *Leuce*, in that it penetrates not ſo deep as the *Leuce* doth.

ALRAMECH, a Star's *Arabick* Name, which is the ſame with *Arcturus*.

ALTAHEST *Paracelſi*, a mix'd Body chymically reduced to its firſt Principles.

ALTERAGE, or *Altaragium*, is a Word that includes not only the Offering made upon the Altar, but alſo the Profit that ariſes to the Prieſt by reaſon of the Altar.

ALTERATION, is, in a Phyſical Senſe, that Motion by which a Body is varied or changed in ſome Circumſtances from what it really was before, tho' as to Senſe, its Nature and Bulk appear to continue ſtill the ſame; ſo that it conſiſts in the Body's acquiring or loſing ſuch Qualities, as whether preſent or abſent, do not *eſſentially* change the Subject: And herein it differs from *Generation* and *Corruption*, which Terms expreſs the Acquiſition or Loſs of the eſſential Qualities of any Body: Or otherwiſe,

ALTERATION is an *accidental and partial Change* made in any Body, without proceeding ſo far as to make the Subject be quite unknown, or to take a new Name or Denomination upon it; or it may be called the *Acquiſition* or *Loſs* of ſuch Qualities as are not eſſential to the Form of any Body.

ALTERING *Remedies*; ſuch Medicines as ſerve to purify and reſtore the due Mixture of Blood, and other circulating Humours.

ALTERNATE *Proportion*: See the Word *Proportion*, N°. 8.

ALTERNATE *Alligation*: See *Alligation Alternate*.

ALTERNATE *Angles*: See *Angles*.

ALTERN BASE, a Term in *Trigonometry*, diſtinguiſhed from the true Baſe thus: In Oblique Triangles the true Baſe is always either the Sum of the Sides (and then the Difference of the Sides is called the *Altern Baſe*); or the true Baſe is the Difference, and then the Sum of the Sides is called the *Altern Baſe*.

ALTERNATION, is a Word uſed by Dr. *Wallis* and others, for the different Changes or Alterations of Order in any Number of things propoſed. Of this that learned Mathematician hath a peculiar Diſcourſe at the End of his *Algebra*. This Alternation is eaſily found, by only continual Multiplication of all the Numbers beginning at Unity. Thus, if it were required to know how many Changes can be rung on ſix Bells, you need only write down 1, 2, 3, 4, 5, 6, and then multiply all thoſe Numbers continually one into another, and the laſt Product gives the Number of Changes, which is 720 Changes.

ALTIMETRY, [of *alta*, high things, and *metiri*, L. or μετρέω, *Gr.* to meaſure,] the Art of taking and meaſuring of *Heights*, whether acceſſible or inacceſſible: See *Altitudes* or *Heights*.

ALTITUDE *of the Eye*, [in *Perſpective*,] is a right Line let fall from the Eye perpendicular to the Geometrical Plane.

The *Altitude* of any celeſtial Phænomena, is an Arch of an Azimuth Circle comprehended between the Horizon and the Phænomena.

This *Altitude* is either true or apparent, if Regard be had to the ſenſible and rational Horizon: See *Horizon*.

Apparent ALTITUDE, is the apparent Elevation of any celeſtial Phænomena above the ſenſible Horizon.

Real ALTITUDE, is the Elevation of any Phænomena above the real Horizon.

Meridian ALTITUDE, is an Arch of the Meridian (which is a vertical Circle) comprehended between the Horizon and the Sun or Star.

To obſerve the Meridian *Altitude* of the Sun or Stars, and thereby to find the Latitude of the Place of Obſervation by the ſeveral Kinds of Inſtruments: See *Obſervation*.

ALTITUDE *of the Pole*, is always equal to the Latitude, or Diſtance of the Place from the Equator.

ALTITUDE *of the Equator*, is always equal to the Complement of the Latitude, that is, to the Number of Degrees the Latitude wants of 90.

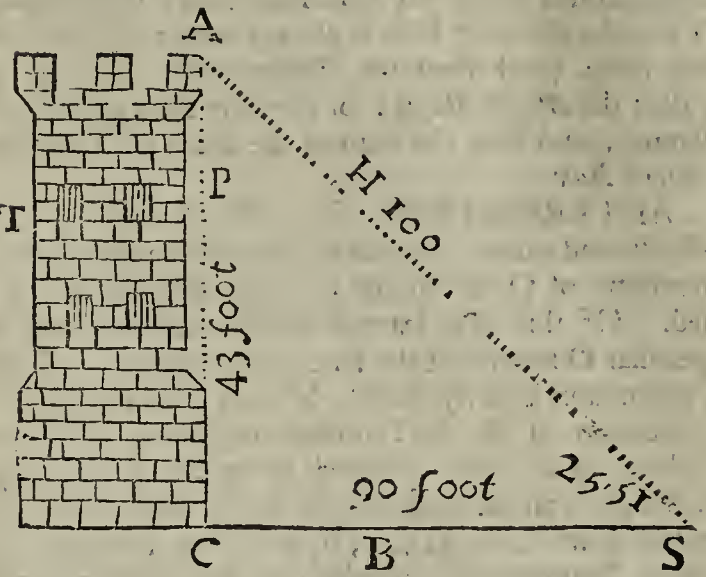
Parallax of ALTITUDE: See *Parallax*.

ALTITUDE *of Motion*, is a Term uſed by Dr. *Wallis* in his *Mechanicks*, for the Meaſure of any Motion, eſtimated according to the Line of Direction of the moving Force.

ALTITUDES, or *Heights of Places perpendicularly above the Horizon*, are thus found, whether acceſſible or inacceſſible, *i. e.* whether they are ſuch whoſe Foot or Bottom you can have Acceſs to, or ſuch as you cannot come near.

1. *To take an Acceſſible Altitude at one Station.*

Let *T* be a Tower ſtanding upon a level Ground whoſe Height is required, your Station being at *S*, 90 Foot diſtant from the Baſis of the Tower.



Firſt, with a Quadrant, Theodolite, or ſome other graduated Inſtrument for that Purpoſe, from your Station *S*, take the Angle of *Altitude A S C*, 25 *Deg.* 1 *Min.* Now you ſee that the perpendicular Height of the Tower *A C*, the Baſe *C S*, and the viſual Line *S A*, do conſtitute a right-angled Triangle, wherein there is given the Baſe *B* 90 Foot, the Angle at *C* a right one, and the Angle of *Altitude* taken by Obſervation 25°. 51'. and therefore the Angle *S A C*, its Complement to 90 *Deg.* = 64°. 60'. and the Altitude *P* is required.

Wherefore, by *Caſe* 1. of right-angled plain Triangles, the Proportion is,

As the Radius is to the Baſe; ſo is the Tangent of the Angle of Altitude to the Height of the Tower. That is, *R* : *B* : : *T*, *S*: *P*.

And the Operation is performed thus:

To the Logarithm of *B*, 90 *F.*	1,954242
Add the *Tang.* of the Angle *S*, 25°. 51'.	9,685290
The Sum will be	11,639532
From which ſubtract the Radius,	10,000000
The Remainder is the Log. of 43 Feet,	1,639532

Which is the perpendicular Height of the Tower.

N. B. Here, and in all ſuch Caſes of this Kind, Allowance muſt be made for the Height of the Eye, or Inſtrument above the Ground.

You may alſo, having the former Requiſites, *viz.* the Baſe and Angles, eaſily find the Hypothenuſe *H*, or how far it is from the Top of the Tower to the Station, by the ſecond Caſe of Rectangle Triangles; and this will be uſeful in many Caſes.

On the common Quadrant you have a Line called the *Quadrat*, which hath two Sides divided each into 100 equal Parts, and that on the Left-hand is called *Right Shadow*, and that on the Right-hand *Contrary Shadow*.

By which Means 'tis very eaſy to take any acceſſible Altitude at one Station by the Quadrant; for, if the Angle *S* be juſt 45, the Diſtance to the Foot of the Tower from the Station is always equal to the Altitude: But if the Angle be leſs than that, the String will fall on *Right Shadow* in the *Quadrat*. Then ſay, as 100 : is to the Number of Parts of the *Right Shadow*, cut by the String : : So is the Diſtance : to the Altitude. So that if the String cut 25, 75, or 50, *&c.* the Height is accordingly $\frac{1}{4}$, $\frac{3}{4}$, or half the Diſtance.

But when the String falls towards the Right-hand, and the Angle *S* be above 45°, then ſay, As the Parts cut by the Thread in the Quadrant : Are to 100 : : So is the Diſtance : To the Height. Wherefore, if the Thread cut 50 here, the Height is double to the Diſtance; if it cut 25, 'tis 4 times as great as the Diſtance, *&c.*

N. B. By applying what is here ſaid of Diſtances to the Shadow of any Objects; the taking their Height by the Length of their Shadows will be eaſily underſtood.

2. *How to take an Inacceſſible Altitude at two Stations.*

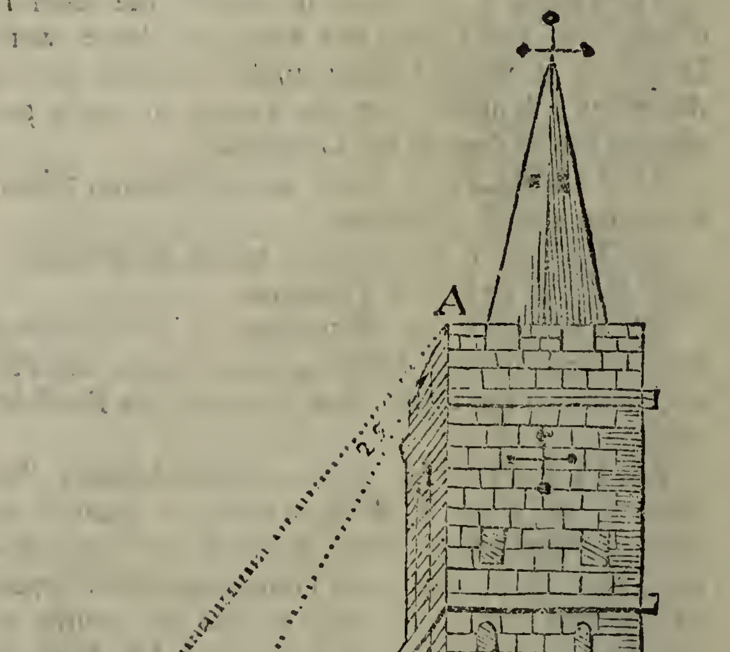
Let *A B* (ſee the following Figure) be a *Church, Steeple*, &c. whoſe Height is required; your Station being at *D*, between which and the Baſis of the *Steeple* there is a River, ſo that it is inacceſſible, that is, you cannot come to the Foot at *B*.

Firſt, from *D* with your Quadrant (or the like Inſtrument) take the Angle of Altitude *ADB*, which ſuppoſe 52 *Deg.* 30 *Min.*

2. Remove your Inſtrument to another Station, as to *C*; where take alſo the Angle of Altitude *A C B*, 27 *Deg.* 30 *Min.*

3. Meaſure the Diſtance between the two Stations *D*, *C*, which let be 92,7 Foot.

Now, the two viſual Lines *D A*, *C A*, together with the Diſtance *D C*, do make the Oblique-angled Triangle *A D C*, wherein there is given the Angle *A C B*, 27°. 30'; and by the Angle *ADB*, 52 *Deg.* 30 *Min.* you have the Angle *A D C*, 127 *Deg.* 30 *Min.* its Complement to 180; and conſequently you have the Angle *C A D* 25 *Degrees*, alſo the Side *D C* 92,7 Feet.



So that having the three Angles and one Side given, the Side *A D* may be found, by *Caſe* 3d of Oblique-angled Triangles; for the Analogy is,

$$\text{As}\begin{cases} S, DAC : D\,C :: S, ACD : AD \\ S, 25\,00 : 92{,}7 :: S, 27{,}30 : 101.\,3 \end{cases}$$

By which Means you gain *A D*, the Hypothenuſe of the right-angled Triangle *A D B*; then in the right-angled Triangle *AD B*, there being given *AD*, the Hypothenuſe, 101, 3, and the Angle *A D B* 52°. 30'. 'tis eaſy to find the Perpendicular *A B*.

By *Caſe* 6. of right-angled plain Triangles, for the Proportion or Canon is,

$$\text{As}\left\{\begin{array}{l} Rad. : AD :: S, ADB : AA \\ S, 90, : 101,3 :: S, 52^{\circ}.\ 30' : 80,3 \text{ Feet.}\end{array}\right.$$

3. *To take the Altitude of a Tower, Steeple, &c. or the like, which ſtandeth upon a Hill.*

Let *H K* (ſee the following Figure) be a Tower ſtanding upon a Hill, and you ſtanding at *L*, deſire to know the Height thereof above the Hill.

Firſt, take the Angle *HLM* 40 *Deg.* as alſo the Angle *KLM* 22 *Deg.* 3 *Min.*

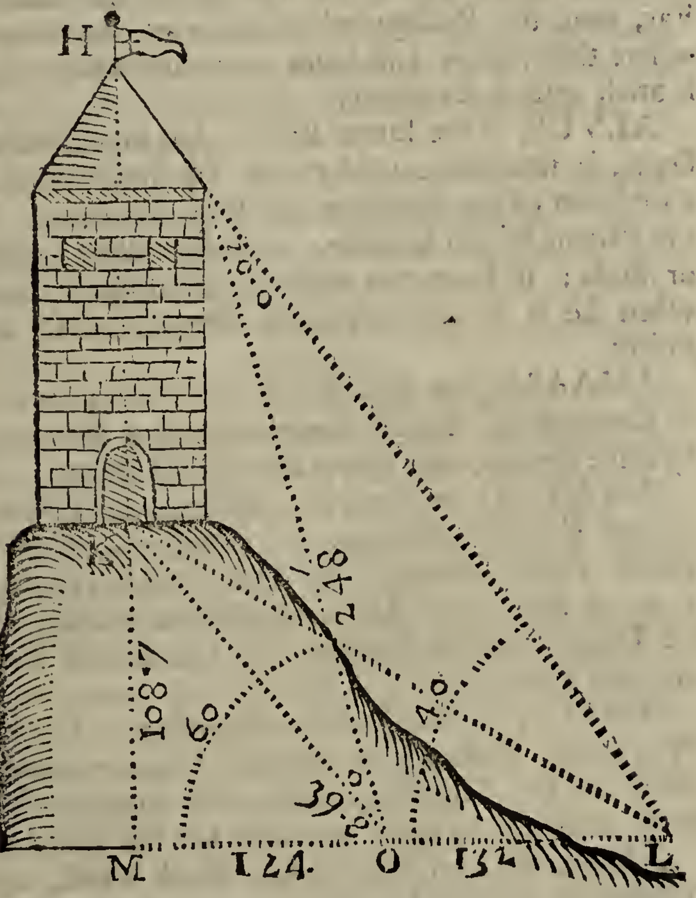
Secondly, remove your Inſtrument to *O*, and take the Angle *HOM* 60 *Deg.* as alſo the Angle *KOM* 39 *Deg.* 54 *Min.*

Thirdly, meaſure the Diſtance *OL* = 132 Feet.

Now, in the Triangle *HOL*, you have given the Angle *HLO* 40 *Deg.* the Angle *HOL* 120 *Deg.* and the Diſtance *LO* 132 Foot. Then, by *Caſe* 3. of Oblique-angled Triangles,

$$\text{As}\left\{\begin{array}{l} S, LHO : OL :: S, HLO : HO \\ S, 20^{\circ}. : 132 :: S, 40^{\circ}. : 218.\end{array}\right.$$

Then, by *Caſe* 1. of Right-angled Triangles, *HM* is found to be 214 Foot.



Now, in the Triangle *HMO*, you have given the Angle *HOM* 60 *Degrees*, and *HO* 248, or the Perpendicular *HM* 214 Foot, required, the Baſe *MO*; 'twill be As, *Rad.* : *HO* :: *S*, *HOM* : *MO* 124 Foot.

Alſo in the Triangle *KMO*, there is given *MO* 124, and the Angle *KOM* 39 *Deg.* 54 *Min.* required *KM*, which by *Axiom.* 2. *Plain Triangles*, is found to be 108,7 Foot, which being ſubducted from *HM* 214, leaves 1053 Foot for the Height of the Tower.

ALTITUDE, [in *Aſtronomy*,] is of the Sun, Stars, or any Planet or Point of the Heavens, an Arch of an Azimuth Circle, contained between the Horizon and any Parallel of Altitude, or between the Star, Planet, or aſſigned Point in the Heavens and the Horizon.

To find the Sun's Altitude at any Time by the Globe, rectify your Globe, and fit the Quadrant of the Altitude; then turn the Globe about till the Hour Index ſhew the Time of the Day, and ſtay it there; after which bring the Quadrant to cut the Sun's Place in the Ecliptick, and then that Place ſhall ſhew the Altitude on the Quadrant.

To find the Sun's Altitude and Hour of the Day, when he is due *Eaſt* or *Weſt*, and above our Horizon, by the Globe.

Having rectified the Globe, and fitted the Quadrant, bring it to cut the true Eaſt Point, and then turn the Globe till the Sun's Place in the Ecliptick cut the graduated Edge of the Quadrant, for then that Place will ſhew the Altitude, and the Index the Hour.

To find the Sun's Altitude on any Azimuth by the Globe.

Set the Quadrant to the Azimuth given, and then turn the Globe till his Place in the Ecliptick touch the graduated Edge of the Quadrant, ſo ſhall that Place give the Altitude on the Quadrant.

By Trigonometrical Calculation

1. To find the Sun's Altitude when it is due *Eaſt* or *Weſt*.

Having the Latitude of the Place, and the Sun's Declination given,

Say, *As the Sine of the Latitude : Is to the Radius :: So is the Sine of the Sun's Decilnation : To the Sine of the Sun's Altitude required.*

Example. Suppoſe the Latitude to be 51°. 30'
And the Sun's Declination 11 31
Then to the Ar.co. of the Sine of 51°.30'0,106455
Add the Sine of 11 31 9,300275

Sum the Sine of 14, 49.9,406730

which is the Sun's Altitude that Day when due *Eaſt* or *Weſt*.

2. To find the Sun's Altitude on any Hour in the Equinoctial,

Say, *As the Radius is to the Co-ſine of the Latitude; ſo is the Co-ſine of the Sun's Diſtance from the Meridian (or Hour from Noon) to the Sine of the Altitude required.*

3. To find the Sun's Altitude at Six,

Say, *As the Radius is to the Sine of the Latitude; ſo is the Sine of the Declination to the Sine of the Altitude at Six.*

4. To find the Sun's Altitude on any Azimuth, Say, *As the Radius is to the Co-ſine of the Azimuth; ſo is the Co-Tangent of the Latitude to the Tangent of the Altitude.*

5. To find the Sun's Altitude at any time, having the Latitude and Declination given,

Say, *As the Radius is to the Sine of the Sun's Diſtance from Six; ſo is the Co-Tangent of the Latitude to the Tangent of the fourth Ark.*

Which fourth Ark, for Hours between Six and Six muſt be ſubtracted from, or for Hours, before or after Six, muſt be added to the Sun's Diſtance from the Pole, and the Sum or Difference ſhall be a fifth Ark.

Then, *As the Co-ſine of the 4th Ark is to the Sine of the Latitude; ſo is the Co-ſine of the 5th Ark to the Sine of the Sun's Altitude.*

Sir *Jonas Moore* gives an eaſier Method for theſe Problems; of which this is his Example for the Hour of the Day.

There is given the Complement of the Sun's Height, his Complement of the Declination, and the Complement of the Latitude of the Place: Required the Angle of the Sun's Diſtance from the Meridian, or the Hour from Noon.

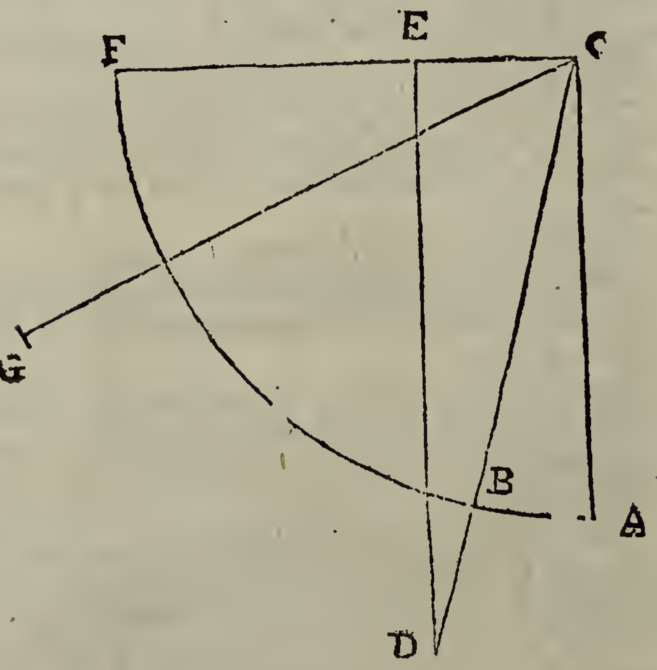
Write all theſe down thus:

Complement of the Latitude	38°.30′.	*Sine Comp. Arith.*	0.205850
Complement of Declination	76. 53.	*Sine Comp. Arith.*	0.011481
Their Difference is	38. 23.		
To which add Comp. of the *Al.*	60. 00.		
The Sum is	98. 23.		
And their Difference is	21. 37.		
Then take the ½ Sum which is	49. 11.		Sine=9.878984
And the half difference, which is	10. 48.		Sine=9.272726
Then add the two Arith. Compl. and theſe two Sines all into one Sum, and it will make			19.369041
The Half of which will be			9.684520

Which laſt Quantity is the Sine of 28°. 56′. Double thoſe Degrees and they make 57°. 12′. which Sum converted into Time make 3 Hours 52 Minutes; which is the Time that the Sun wants of being at the Meridian, or it is the Hour of Eight a-Clock Nine Minutes before Noon; or Three a-Clock and Fifty one Minutes after Noon.

ALTITUDE *of the* Sun. *To find it readily at any time without a Quadrant, or ſuch like Inſtrument.*

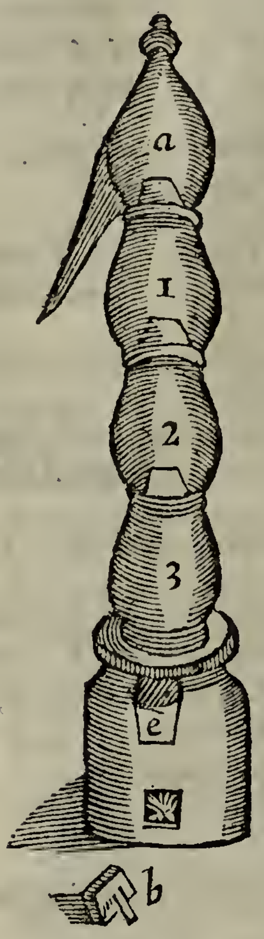
On any plain Place erect a Pin or Wire perpendicularly as in the Point *C*: From which Point, you had before with 60 of a Line of Chords, deſcribed the Quadrantal Arch *A F*, make *C E* equal to the Height of the Pin or Wire, and through *E* draw *E D* parallel to *C A*, and make it equal to *C G* the Length of the Shadow. Then with a Ruler laid from *C* to *D*, interſect the Quadrant in *B*, and *B A* is the Arch of the Sun's Altitude, when meaſur'd on the Line of Chords.



ALTO *and* BASSO, (or, *in Alto & in Baſſo*) in *Law*, ſignifies the abſolute Submiſſion of all Differences, ſmall and great, high and low, to a Judge or Arbitrator.

ALUDELS, are Pots uſed by the Chymiſts in Sublimations: They are without Bottoms, and are fitted into one another as many as there is Occaſion for: At the Bottom (in the Furnace) there is a Pot holding the Matter to be ſublim'd; and at the Top there is a Head to receive the Flowers that ſublime up thither.

This is the Figure of them.



a the Head.

1, 2, 3. three *Alludels*.

e the Pot holding the Matter to be ſublimed.

f the Fire Place.

b the Stopple of the Fire Place.

ALVEARIUM, is the Cavity of the inward Ear, near the Paſſage which conveys the Sound, where that yellow and bitter excrementitious Stuff is bred, called *Ear-wax*.

ALVUS, is the lower Belly; but in a *Medical* Senſe, is ſometimes uſed rather for the State and Condition of the Inteſtines and their Contents. If the Patient be too laxative, it is called *Alvus liquida* or *fluida*; if he be too coſtive, *Alvus dura*; and when he is ſo in a very great Degree, *Alvus adſtricta*.

AMAASA, are ſuch Pieces of Glaſs as are us'd in Enamelling, and are ſometimes called *Encauſta*; by ſome *Smalta*, and *Terræ Saracenicæ Bruno*.

AMABYR, or *Amvabyr*, was the old Cuſtom of the *Pretium Virginitatis Domino ſolvendum*. *Henry Eaſted Arundel*, by Deed dated 31 *Aug.* 3, 4. of *Phil.* and *Mar.* releas'd this Cuſtom to his Tenants by the Name of the Cuſtom of *Amabyr* and *Cherage*.

AMAIN, a Word uſed at Sea when a Man of War giveth Defiance to another Ship, or biddeth her ſtrike her Topſails or yield; for to bid a Ship *ſtrike amain*, is to order her to let fall her Topſails.

AMALGAMATE, a Chymical Term, ſignifying the mixing Quickſilver with ſome melted Metal: The Deſign of which is either to render the Metal fit to be extended on ſome Works, as in Gilding, &c. or elſe to reduce the Metal into a very ſubtile Powder.

The *Amalgama* of Gold is thus made; Take a Dram of the Regule of Gold, beat it into very thin little Plates, which heat in a Crucible red hot in a ſtrong Fire, then pour on it an Ounce of pure Quickſilver; ſtir the Matter with an Iron Rod, and when you find it beginning to raiſe a Fume, which will ſoon happen, caſt it into an earthen Pan filled with Water; it will coagulate and become tractable. Waſh it often to take away its Blackneſs, and preſſing from it with your Fingers and in a Linnen Cloth, that Mercury that remains ununited with the Gold. The Gold will retain about thrice its Weight of the Mercuy. If you would reduce the Gold into Powder, put this *Amalgam* into a Crucible over a gentle Fire, and the Mercury will evaporate into the Air, and leave the Gold at the Bottom in an impalpable Powder, which you may melt into its Form again; and if it ſhould retain any Blackneſs from the Mercury, Oil of Tartar *per deliquium* will fetch it off.

For Experiment Sake, you may make a luminous *Amalgama* after this Manner.

Put into a long Vial 10 Grains of the *Phoſphorus* made from Urine, and pour on it two Drams of Oil of Aſpike; the Glaſs muſt be large enough for two Thirds at leaſt to remain empty. Heat it a little with a Candle, and the *Phoſphorus* will diſſolve with an Ebullition: Whilſt this Diſſolution is making, pour into it half a Dram of pure Quickſilver, ſhaking the Glaſs that the Matter may be ſtirred and mixed. You will have an *Amalgama* which will appear all of Fire in the Dark; but it muſt, like the *Phoſphorus*, be kept cloſe ſtopped from Air, elſe it will ſoon be ſpoiled.

If the *Amalgama* of Gold be deſigned to be ſo hard as to be fit to be powdered, you muſt uſe three Parts of the Metal, and two of Mercury; but if you would have it ſo ſoft as to ſpread, you muſt uſe three Parts of Mercury to one of the other Metal.

AMALGAMATION, the Act or Operation of making an *Amalgama.*

AMANSES, a barbarous or fictitious Word which ſome of the canting Chymiſts uſe for counterfeit Gems and precious Stones.

AMARACINON, is a very precious Ointment prepared with rich Oils and highly aromatick Spices.

AMATORII, [in *Anatomy*,] thoſe Muſcles of the Eyes that draw them ſideways, and aſſiſt in the Look call'd *Ogling*.

AMAUROSIS, is a Dimneſs of Sight, whether the Object be placed near or at a Diſtance; but ſo that no external Fault appear in the Eye, if you inſpect it never ſo narrowly; the Defect conſiſts in the Obſtruction of the Optick Nerve: It is called alſo *Gutta Serena*. *Blanchard.*

AMBAGES, an idle Circumlocution, or vain connecting together of far-fetch'd Words or Sayings, remote from the true Purpoſe of the Speaker.

AMBE, [ἀμβὴ, *Gr.*] is a ſuperficial jutting out of the Bones; alſo a Surgeon's Inſtrument with which disjointed Bones are ſet again.

AMBIDEXTER, (in *Law*,) ſignifies that Juror or Embraceor that takes Money of both Parties for giving his Verdict, for which he forfeits ten times as much as he takes. *L.*

And ordinarily, *Ambidexter* denotes that Man that can equally uſe both his Hands.

AMBIENT, [*ambiens*, *L.*] encompaſſing round about: Thus the Bodies which happen to be placed round any other Body are called the *ambient*, and often the *circumambient* Bodies; and the whole Body of the Air, becauſe it encompaſſes all things on the Face of the Earth, is often by Phyſical Writers called, by Way of Eminence, the *Ambient*.

AMBIT, [*Ambitus*, *L.*] of any Figure in Geometry, is the Perimeter, Circumference or Sum of all the bounding or encompaſſing Lines that include it.

AMBIGENAL *Hyperbola*, is an Hyperbola which hath one of its infinite Legs inſcrib'd in it, and the other circumſcrib'd about it.

AMBLIGONIAL, [in *Geometry*,] ſignifies *Obtuſe-angular*, or that the Sides of any plane Figure make an obtuſe Angle one with another. Thus an *Ambligonial Triangle* is that which hath one obtuſe Angle.

AMBLIOPIA, [Ἀμϐλυωπία, *Gr.*] is a Dulneſs or Dimneſs of Sight when the Object is not clearly diſcerned at what Diſtance ſoever placed, and proceeds from an imperfect Obſtruction of the Optick Nerves, a light Suffuſion, Want of Spirits, or Groſſneſs of the ſame, *&c.* Some reckon four Kinds of *Ambliopia*, viz. *Myopia*, *Presbytia*, *Nyctalopia*, and *Amauroſis*; which ſee under thoſe Words. *Blanchard.*

AMBLOTICK, [Ἀμβλωτικὰ, of Ἀμβλωσις, *Gr. Abortion*,] *Medicines*, are ſuch as cauſe Abortion.

AMBUSCADE, a Place where Soldiers hide themſelves to ſurpriſe the Enemy.

AMBUSTION, [in *Surgery*,] a Solution of the Continuity of Parts; a Burn or Scald cauſed by ſome external Burning.

AMENABLE, [of *amener*, *F.*] tractable, that may be led or governed.

AMENDMENT, (a Common-Law Term) ſignifying the Correction of an Error committed in a Proceſs, and eſpied before Judgment, but may be amended by the Juſtices after Judgment; and if there be Error in giving Judgment, they may not amend it, but the Party is to put in his Writ of Error.

AMERCEMENT. Dr. *Kennet*, in the Gloſſary at the End of his *Parochial Antiquities*, ſhews, that *Amerciamentum* is a pecuniary Puniſhment impos'd upon Offenders *a la mercie*, at the Mercy of the Court; and therefore in our Law is frequently call'd *Miſericordia*; and there is this ſtated Difference between *Fines* and *Amercements*; *Fines* are Puniſhments certain and determined by ſome Statute; but *Amercements* are arbitrary Impoſitions proportioned to the Fault, at the Diſcretion of the Court.

AMERCEMENT *Royal*, is when a Sheriff, Coroner, or other ſuch Officer of the King, is amerced by the Juſtices for Abuſe in his Office.

Blunt makes this Difference between *Amercements* and *Fines*; that the latter, as taken for Puniſhments, are Puniſhments certain, which grow expreſly from ſome Statute; and *Amercements* are arbitrarily impoſed by Affeerors.

AMETHIST, [in *Heraldry*,] is the Term for the purple Colour in the Coat of a Nobleman; which in all Gentlemens Eſcutcheons below that Degree is called *Purpure*, and in thoſe of Sovereign Princes, *Mercury*.

AMETHYSTA, are ſuch Medicines as will preſerve Men from being ſoon inebriated with Wine or ſtrong Liquors.

AMITTERE *Legem Terræ*, a Law Term, ſignifying to loſe the Liberty of Swearing in any Court, to become infamous; the Puniſhment of a Champion overcome or yielding in a Fight, or in Battle, and the Jurors found guilty in a Writ of *Attaint*, and of a Perſon outlawed: *L.*

AMMONION, is by ſome Writers uſed for *Collyrium*; which ſee.

AMNESTY, [Ἀμνεστία, *Gr.*] is an Act of Oblivion, ſuch as was granted at King *Charles*'s Reſtauration.

AMNION, or AMNIOS, [Ἀμνιον, *Gr.*] is the innermoſt Membrane with which the *Fœtus* in the Womb is moſt immediately covered, and with which the reſt of the *Secundines*, the *Chorion*, and *Allantois* is ejected after the Birth; it is whiter and thinner than the *Chorion*: It contains not only the *Fœtus*, but the nutritious Humour, whence the *Fœtus* by the Mouth and Throat ſucks its Nouriſhment. It is outwardly cloathed with the urinary

Membrane and the *Chorion*, which ſometimes ſtick ſo cloſe to one another, that they can ſcarce be ſeparated, though it is not knit to the *Chorion* in any Place, ſave where the umbilical Veſſels paſs through them both into the *Placenta.* It hath Veſſels from the ſame Origin as the *Chorion.*

Before the *Ovum* is impregnated, this Membrane contains a limpid Liquor, out of which, after Impregnation, the *Embryo* is formed. In it (ſays *Gibſon*) reſides the Plaſtick Power, and the Matters alſo out of which the firſt Lineaments of the *Embryo* are drawn; but becauſe its Liquor is ſo very little, there tranſudes through this Membrane the *Amnion*, a Part of the nutritious albugineous Humour which is contained in the *Chorion*, which it had imbibed out of the *Uterus*, and by the *Juxta*-Poſition or Addition of its Humour to undiſcernible Rudiments of the *Embryo*, it receives its Increaſe. But though the *Amnion* have its additional nutritious Liquor at firſt only by Tranſudation, yet when the umbilical Veſſels and the *Placenta* are formed, it receives it after another Manner; for then its Liquor at firſt being ſeparated from the Mother's Arteries by the *Placenta*, and imbibed by the umbilical Vein of the *Fœtus*, it paſſes directly to its Heart, from whence being driven out by the *Aorta*, it is ſent forth again, in good Part, by the umbilical Arteries, out of whoſe Cavities being plentifully diſperſed through the *Amnion*, it iſſues into its Cavity, juſt as the Juices, which are far more groſs and viſcid than this, do ſometimes critically, and often on taking a Purge, ouze into the Inteſtines out of the ſmall Mouths of the Arteries: Indeed, here the Intervention of the Glands aſſiſt this Matter; but it is hoped ſome curious Perſon one time or other will diſcover that there are ſuch alſo in the *Amnion.*

To AMORTISE, (a Term in *Law*) is to alien Land or Tenements to any Corporation, Guild, or Fraternity, and their Succeſſors, which cannot be done without Licence of the King, and the Lord of the Manor.

AMOUSES, counterfeit Gems, or precious Stones.

AMPELITE, [Αμπελίτης, *Gr.*] in Agriculture, is a Kind of black or bituminous Earth uſed about Vines, to make them thrive the better.

AMPHIBOLOGY, [᾿Αμφιβολογια, *Gr.*] a Grammatical Figure, when our Expreſſions ſeem to look one Way, and are intended another.

AMPHIBLESTROIDES, or the *Tunica Retina* or *Retiformis* of the Eye, is a ſoft, white and ſlimy Subſtance; which is ſo named, becauſe that being thrown in the Water reſembles a Net; it ſhoots from the very Centre of the Optick Nerve, and conſiſts of the medullar Subſtance of it, and expanding it ſelf over the Vitreous Humour, is extended as far as the *Ligamentum ciliare*, or the Ligaments of the Eye-lids: This Tunic, in that it is whitiſh, and of a marrowy Subſtance, ſeems to proceed from the very marrowy and fibrous Subſtance of the Optick Nerve; ſo that it is, as it were, an Expanſion of nervous Fibres, which are there gathered into one Bundle, into a Contexture made like a Net; and indeed if the whole Eye were taken for a Flower, growing, as it were, to the Brain by the Stalk of the Optick Nerve, the *Tunica Retina* would be the very Flower it ſelf, and the two other Tunicles, the *Sclerotica* and *Choroides*, be only in the Nature of a Stem. This Tunic ſeems to be the principal Organ of Sight, and receives the viſible Species within the Bed of the Eye much after the Manner of a whited Wall, or a Piece of white Paper in a darkned Chamber, receives and repreſents the viſible Species which are intromitted through a little Hole. See *Camera obſcura.*

AMPHIBRACHYS, is the Foot of a *Latin* Verſe conſiſting of three Syllables, where the two Extreams are ſhort, and the Middle long, as *Amare.*

AMPHIBRANCHIA, are Places about the Glandules in the Jaws, which moiſten the *aſpera Arteria* and the Stomach.

AMPHIBIOUS, is uſed for an Animal that lives both on Land and in the Water, as an Otter, Beaver, *&c.*

AMPHIDÆUM, with ſome Writers, is the Summit or Top of the Mouth of the Womb. *Blanchard.*

AMPHIPROSTYLE, a Term in Architecture for a Kind of Temple of the Ancients, which had four Columns in the Front, and as many in the Face behind.

AMPISCII; ſo the Inhabitants of the *Torrid Zone* are called, in reſpect of their Shadows; becauſe their Shadows fall both Ways, *viz.* to the South (as ours always do to the Northward) when the Sun is beyond them in Northern Signs, and to the North when the Sun is to the Southward of them in Southern Signs.

AMPHISMELA, is an Anatomical Inſtrument uſed in the Diſſection of Bones.

AMPHITHEATRE, is a Place built for acting and ſeeing of publick Spectacles and Stage-plays: The common Theatre was but ſemicircular, but this was built entirely round, or in the Form of a perfect Circle.

AMPHORA, was anciently a Meaſure of Capacity, ſometimes called κεβάμιον, and was of two ſorts; the *Italian Amphora*, which *Galen* ſaith, held 72 Pounds of Water; the *Attick Amphora*, which was larger, and was called μετρήτος. See *Weights and Meaſures.*

AMPLIATION, [in *Law*,] ſignifies a deferring of Judgment till the Cauſe be further examined.

AMPLITUDE *of the Sun and Stars*, is an Ark of the Horizon intercepted between the true Eaſt and Weſt Points of it, and the Center of the *Sun* or *Stars* at their riſing or ſetting; and ſo is either *North* and *South*, or *Ortive* and *Occaſive.*

To find the Sun's Amplitude, either Riſing or Setting by the Globe, bring the Sun's Place to the Horizon either on the *Eaſt* or *Weſt* Side, and the Degrees from the *Eaſt* Point either *North* or *South*, are the Amplitude required.

To find the *Sun's Amplitude Trigonometrically:* Having the Latitude and the *Sun*'s Declination given;

Say, *As the Co-ſine of the Latitude is to the Radius, ſo is the Sine of the preſent Declination to the Sine of the Amplitude.*

Example. Suppoſe the Latitude to be 51 *deg.* 30 *min.* and the Declination of the ſame 11 *deg.* 50 *min.*

Then to the Ar. co. of the Co-ſine of } 50°. 30′. 0, 2058503
Add the Sine of ———————— 9, 3118926

Sum is the Sine of ——— - - - 9, 5177429
Which is the Amplitude required.

AMPLITUDE *Magnetical:* See *Magnetical Amplitude.*

AMPLIFICATION, (in *Rhetorick*,) is a figurative Speech aggravating a Crime, enlarging in Praiſe of another, inſiſting upon a Relation, *&c.*

AMPUTATION, is the Surgeon's Term for the cutting off any Member of the Body.

AMULET, [*Amuletum, L.*] any thing that is hung about the Neck, or any Part of the Body, ſuppoſed to be good againſt Witchcraft or Diſeaſes. Theſe were called anciently *Prœbia*, *Apotropæa*, *Phylacteria*, *Amynteria*, *Alexiteria*, and *Alexipharmaca*.

AMMUNITION, in the general, is all ſorts of Warlike Stores and Proviſions, eſpecially Powder and Ball.

AMMUNITION *Bread*, in an Army, is that which is provided for and diſtributed to the Soldiers.

AMY, is a *Law Term*, ſignifying the next to be truſted for an Orphan or Infant.

AMYGDALATE, [in *Pharmacy*,] is an artificial Milk, or Emulſion made of blanch'd Almonds, *&c.*

AMYGDALÆ, [Ἀμυγδάλη, *Gr.*] See *Tonſillæ*.

ANA, a Kind of barbarous Word uſed amongſt the Writers of Pharmacy, and ſignifies that an equal Quantity of thoſe Ingredients with which it is connected, is taken for the Compoſition of any Medicine.

ANABIBAZON, the *Dragon's Head*, or the Northern Node of the Moon, where ſhe paſſes the Ecliptick from *South* to *North Latitude*, is ſometimes ſo called.

ANABROCHISMUS, is a Way of drawing out the inverted pricking Hairs of the Eye-lids, by Means of a Thred of a fine Silk in the Eye of a Needle, which when you have doubled, you put the Hair through, and ſo draw it out.

ANABROSIS, [ἀνάβρωσις, of ἀναβρώσκω, *Gr. to eat through*,] is a conſuming or waſting of any Part of the Body by ſharp Humours.

ANACAMPTICK, [of ἀνακάμπτω, *Gr. to reflect*,] ſignifies Reflecting ; it is frequently uſed in Reference to Echoes, which are Sounds produced *anacamptically*, or by Reflection ; and therefore *Anacampticks* is by ſome taken for *Catoptricks*.

ANACATHARSIS, [ἀνακάθαρσις, of ἀνὰ and καθαίρω, *Gr. to purge*,] is a Medicine that diſcharges Nature by ſome of the upper Parts ; as any thing that provokes to vomit, to ſneezing, to ſalivate, *&c.* in which laſt Senſe *Hippocrates* uſed the Word, as *Galen* ſaith.

ANACATHARTICK *Medicines*, are ſuch as cauſe Vomiting.

ANACEPHALEOSIS, [ἀνακεφαλαίωσις, of ἀνὰ and κεφαλὴ, *Gr. the Head*,] is a brief Summary or Recapitulation of the Heads of any Matter ſpoken or delivered in Writing.

To ANCEPHALIZE, to repeat the Heads of Matters.

ANACHRONISM, [of ἀνὰ and χρονίζω, *Gr. to fix, at a Time higher or backwards*,] an Error in Chronology, an undue Connection of Time, or a falſe Chronicling.

ANACLATICKS, [of ἀνὰ and κλίνω, *Gr.*] a Part of Opticks which treats of all ſorts of *Refractions*, and is the ſame with *Dioptricks*.

ANACOLLEMA, [of ἀνακολλάω, *Gr. to glue together*,] is a Kind of Linement or dry Medicine to be applied to the Forehead or Noſe in Diſeaſes of the Eyes, or to ſtop Bleeding ; alſo a Medicine which will breed Fleſh, and conglutinate the Parts.

ANACREONTICK *Verſe*, is a Kind of Verſe conſiſting of ſeven Syllables, without being tied to any certain Law or Quantity ; ſo called from its Author *Anacreon*, a *Lyrick* Poet.

ANADIPLOSIS, [Ἀναδίπλωσις, of ἀνὰ and διπλόω, *Gr. to double*,] a Figure in Rhetorick, when one Verſe begins with the ſame Word the laſt ended with. It is alſo ſometimes uſed in Medicine, for the Reduplication of the Paroxyſms or Fits of Fevers; and in this Senſe it is called by ſome Writers *Epanadiploſis*.

ANADOSIS, [Ἀνάδοσις, *Gr.*] is ſometimes uſed for whatever tends upwards in the Body, as a Vomit, *&c.* but moſt uſually for the Diſtribution of the Chyle through the proper Veſſels.

ANAGLYPHICK *Art*, [Ἀναγλυπτικὴ, *Gr.*] is the Art of Carving, Engraving, or Emboſſing.

ANAGOGICAL, [of Ἀναγωγὴ, *Gr.*] the ſame with *Myſterious*, or which hath an elevated, raiſed, uncommon Signification, or which raiſes the Mind up to Divine Contemplations.

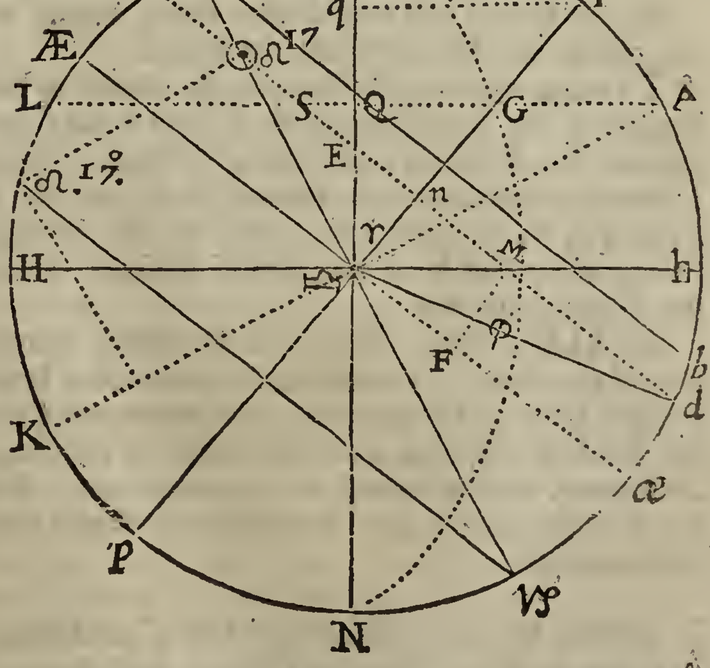
ANAGRAM, [Ἀναγραμμα, *Gr.*] is the Tranſpoſition of the Letters of any one's Name, Title, *&c.* in order to make out from thence ſomething to the Honour of the Perſon. Thus *Galen* by Tranſpoſition is *Angel*, &c.

ANALEMMA, [Ἀνάλημμα, *Gr.*] is a Projection of the Sphere on the Plane of the Meridian; orthographically made by ſtrait Lines and *Ellipſes*; the Eye being ſuppoſed to be at an infinite Diſtance, and in the *Eaſt* or *Weſt* Points of the Horizon.

To deſcribe the Analemma.

With 60 Degrees of —— the Line of Chords; deſcribe the *Meridian Z H N b*, which is the primitive Circle:
Then draw the Diameters *Z N* and *H h* at Right Angles one to another: Then will
H h be the Horizon:
P the North Pole, elevated above the Horizon 51°. 30′.
p the South Pole.
P p the *Axis* of the World.
Æ æ the Equinoctial at Right Angles with *P p*.
Z the Zenith:
N the Nadir:
Z N the *Axis* of the Horizon, the prime vertical Circle, or *Eaſt* and *Weſt* Azimuth.

The *Analemma* for the Lat. 51°. 30′. *North.*



At the Diſtance of 23 *deg.* 30 *min.* (on the Limb) each Way from *Æ* and *æ* draw,

♋ *b* the Tropick of *Cancer.*

♑ *o* the Tropick of *Capricorn*; draw alſo

♋ ♑ the Ecliptick, and at Right Angles to it,

A K the *Axis* of the Ecliptick.

Let *D d* drawn any where parallel to the Æquator, and repreſenting a Parallel of the Sun's Declination, or the Sun's Diurnal Ark for that Day.

M } the Point of { Rising or Setting.
D } the Sun's { *Culminating*, or being on the Meridian.

Then will ♈ *M* repreſent the Sun's Amplitude, and the Parts of the Parallel.

D M } the Sun's Semi- { Diurnal } Ark.
d M } { Nocturnal }

n ☉ the like Sine of the Sun's Right Aſcenſion.

M n the like Ark of his aſcenſional Difference.

H D the Sun's Meridian Altitude.

L A a Parallel of Altitude, or *Almacanter.*

♈ *Q* or ♈ *q*, the Sine of the Sun's Meridian Altitude when he is at *L* and at *D*.

To find the Arches of leſſer Circles, which Mr. *Oughtred* calls *Like Arks*: Say,

As the Semi-diameter of any Parallel is to the like Diſtance in that Parallel, ſo is the Radius of the primitive Circle to the Sine of the true Diſtance from the Centre.

So that if by this Method, you will find *n M*, the like Sine of the aſcenſional Difference.

To the End of the Parallel *D d*, draw the Radius ♈ *d*, and from the Point *M*, draw *E φ* parallel to *P p*; that Parallel will cut the Legs of the Triangle ♈ *d n* proportionally; ſo that

n d : *n M* :: ♈ *d* : ♈ *φ* (= ♈ *F*) the Sine of the aſcenſional Difference.

If the Sun be in the 17th *deg.* of *Leo*; then he muſt be 47 *deg.* diſtant from the firſt Degree of *Cancer.*

Wherefore ſet 47 *deg.* on the Limb from ♋ to ♌ 17, and from thence take the neareſt Diſtance to *k* ♈, the *Axis* of the Ecliptick, and ſet it from ♈ to ☉ on the Ecliptick, ſo ſhall it be the Sine of the Ark ♌ 17 *k*, 43 *deg.* or the Sine of the Sun's Diſtance from the next Equinoctial Point.

To deſcribe the Azimuths, Meridians, or Hour Circles, which in the *Analemma* are *Ellipſes.*

As ſuppoſe, to draw an Azimuth through the Points Z *M N.*

Draw as many Parallels as you will to the Horizon, 'twill always be, as

♈ *h* : ♈ *M* :: *Q* λ : *Q G* :: *P q* : *q r*, &c.

By this Means you may find as many Points as you pleaſe, as *r G*, to deſcribe the *Ellipſes.*

To bring which to Practice, ſet the Sector to the Radius of the Parallel, and then from it take the Sine of the Azimuth's Meridian, or Hour Circle's Diſtance from the prime Vertical Z *N*, and ſet it from *Q* to *G*, or from *q* to *r*, &c. which will find you as many Points as you pleaſe, through which the *Ellipſis* muſt paſs.

ANALEMMA. When all the whole Furniture of this Kind of Projection is drawn on a large Plate of Braſs or Wood, with an Horizon and Curſor fitted to it, then that Inſtrument is called an *Analemma*, and is indeed a very uſeful one. For by it may readily and univerſally be found ſuch things as theſe.

I. *Having the Pole's Height and Day of the Month, to find the Time of the Sun's Riſing and Setting, and conſequently the Length of Day and Night any where.*

Count the Latitude from the polar Point where all the elliptical Meridians meet either *N* or *S*, as ſuppoſe 49 *deg.* and bring the fiducial Edge of the Horizon to that Degree of Latitude in the Limb, and mark where the Horizon cuts the Parallel for that Day; as ſuppoſe *April* 20, or when the Sun enters into *Taurus.* Obſerve alſo which of the Hour Circles that Point of Interſection is neareſt to, and that will give you the Time of the Sun's Riſing, in this Caſe about Five, or a little after; and therefore it will ſet as much before Seven. The Time of its ſetting being doubled, gives the Length of the Day; and that of its Riſing doubled, gives the Length of the Night.

II. *To find the Length of the Longeſt Day in any Latitude.*

Bring the moveable Horizon to the Pole's Height in the Limb, as before, and then mark the Point where it cuts the Parallels of ♋ or ♑; (according as your Latitude is *North* or *South*) and then obſerve which of the Hour Circles is neareſt to that Point of Interſection, as before.

III. *Having the Latitude, Sun's Place, and Altitude, to find the Hour of the Day.*

Bring the Horizon to the Latitude, ſuppoſe as before 49 *deg. N.* and the Sun's Place being 00 of *Taurus*, and his Altitude obſerv'd by a Quadrant, or otherwiſe 18 *deg.* Then ſince the Degrees of the Curſor denote the ſeveral Parallels of Altitude, move the Curſor till 18 *deg.* on it will juſt cut the Parallel of 00 ♉ or *April* 20. for then that Hour Circle, which (as before) is next the Point of Interſection, will ſhew the Time of the Day, which in this Inſtance will be either Seven in the Morning, or Five in the Afternoon. And this will give the Hour very well, except between 11 and 12, and 12 and 1, where the Hour Circles run a little too cloſe to ſhew it exactly.

How to find the Sun's Declination, Right Aſcenſion, Altitude, Azimuth and Hour, &c. by a ready and eaſy Projection of Part of the *Analemma*, you will find under thoſe Words.

ANALEPTICKS, [Ἀναληπτικὰ, of ἀναλαμβάνω, *Gr. to re-eſtabliſh or reſtore,*] are Medicines which cheriſh and renew the Strength; it ſignifies alſo a Part of *Hygieina*, or the Art of preſerving Health, whereby weak Perſons are recovered.

ANALGESY, [Ἀναλγησία, *Gr.*] an Indolency, a being free from Pain and Grief.

ANALOGY, [Ἀναλογία, of ἀνὰ and λογίζω, *Gr.*] (in *Mathematicks*) is the Compariſon of ſeveral *Ratio's* together, much the ſame with *Proportion*; which ſee. And it is frequently uſed in common Diſcourſe for the Word *Proportion.*

ANALOGISM, [Ἀναλογισμὸς, *Gr.*] (in *Logick,*) a forcible Argument from the Cauſe to the Effect, implying an unanſwerable Neceſſity.

ANALYSIS, [Ἀνάλυσις, of ἀνὰ and λύσις *Gr. a Solution,*] is divided with Regard to its Object, into the Doctrine of *finite* and that of *infinite Quantities.*

ANALYSIS of *finite Quantities*, is that which we otherwiſe call *Algebra*, or *Specious Arithmetick*; ſee *Algebra.*

ANAMORPHOSIS.

Fig. 1.

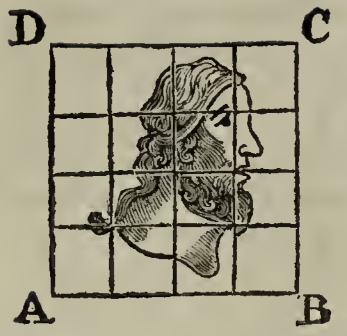


Fig. 2.

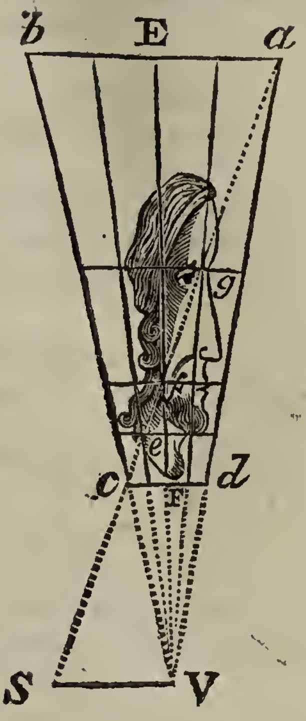


Fig. 3.

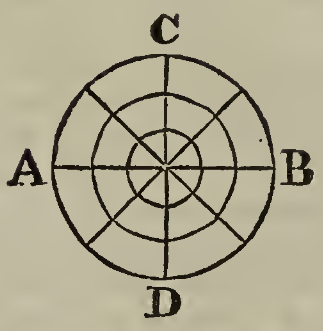


Fig. 4.

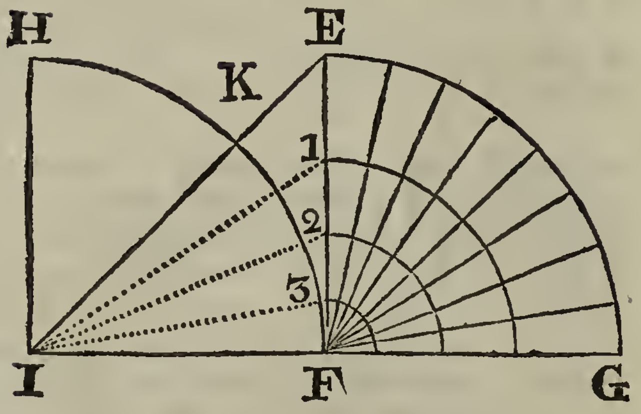


Fig. 5.

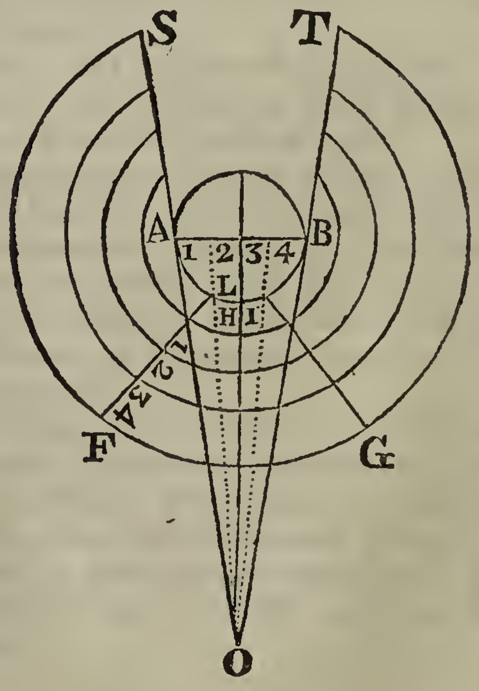


Fig. 6.

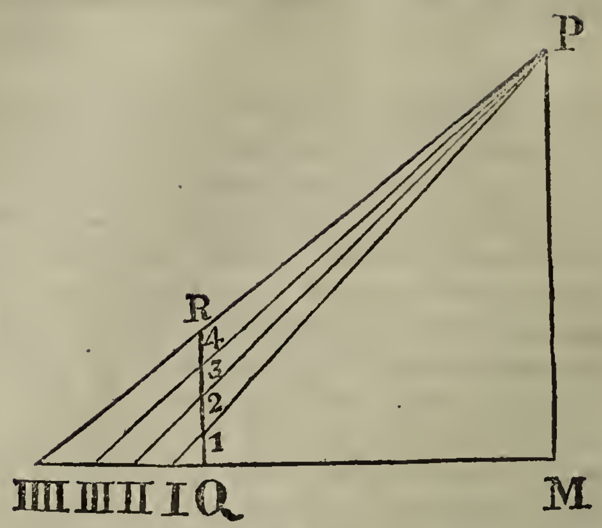


Fig. 7.

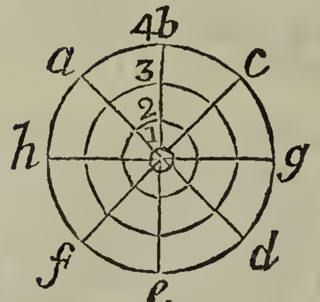


Fig. 8.

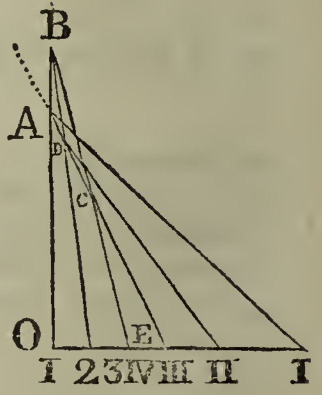


Fig. 9.

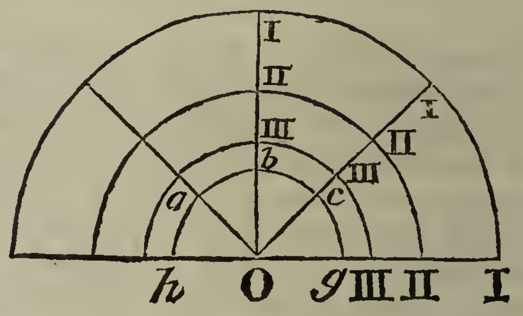


Fig. 10.

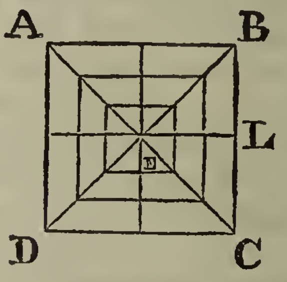
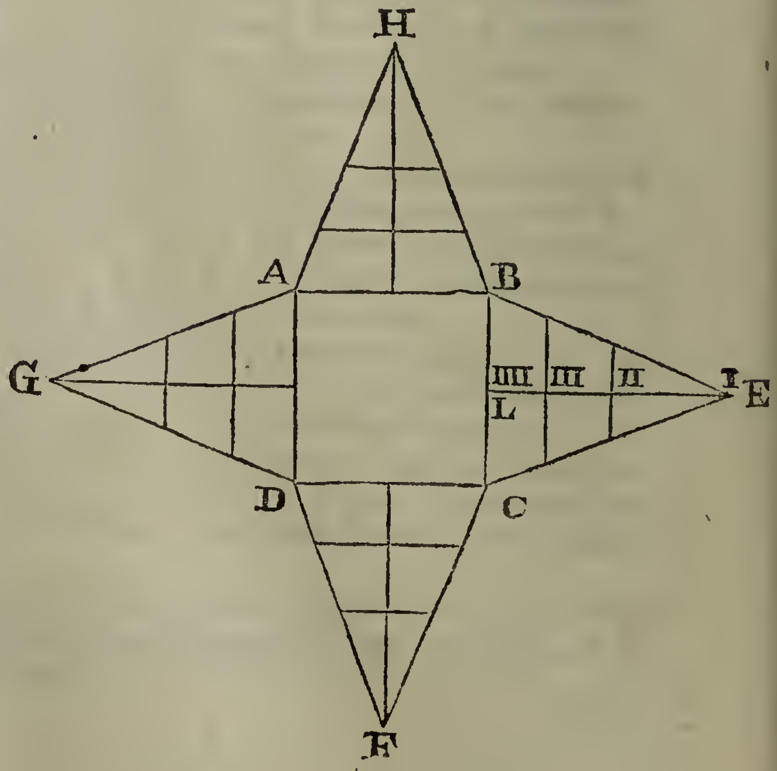


Fig. 11.



To face 1 M Vol. I.

ANALYSIS *of Infinites*, called alſo the *New Analyſis*, is particularly uſed for the Method of *Fluxions*, or *Differential Calculus*; ſee *Fluxions*.

ANALYSIS, a Reſolution of any thing into its component Principles: Thus a Chymiſt is ſaid to *analyze* Bodies, when he diſſolves them by the Fire, and endeavours to find out their conſtituent Parts: And *Algebra* is ſometimes called the *Analytick Art*, becauſe it teaches us to ſolve Queſtions, and to demonſtrate Theorems, by enquiring into the Bottom, into the Fundamental Conſtitution and Nature of the Thing, which is, as it were, reſolved into its Parts taken all to Pieces, and then put together again, ſo that we may ſee into the Reaſon and Nature of it. And in this Senſe *analytical* Demonſtrations are oppoſed to *ſynthetical* ones; which ſee. The Ancients had ſome Knowledge of this Art, but kept it concealed; whoſe Invention *Theo* aſcribes to *Plato*, and he defined it (according as *Vieta* renders it) *Aſſumpti Quæſiti tanquam conceſſi, per Conſequentia ad verum Conceſſum*; a taking of that as granted, or confeſſed which is enquired after, and thence going back by Conſequences to what is confeſſedly true.

ANALYTICK, [Ἀναλυτικὴ, *Gr.*] in *Logick*, is a Part of that Science teaching to decline and conſtrue Reaſon, as Grammar doth Words. Our famous *Butler* makes his impertinent Hero and Scholar *Hudibras*, to be *profoundly skill'd* in *Analytick.*

ANAMNITICKS, [of Ἀνάμνησις, *Gr. the Memory*,] Medicines proper to reſtore a decayed Memory.

ANAMORPHOSIS, [of ἀνὰ and μορφωσις, of μορφὴ, *Form* or *Shape*,] a monſtrous Projection in Perſpective and Painting; or the Repreſentation of ſome Figure or Image, either upon a plain or curved Surface in a deformed Shape, which beheld at a proper Diſtance ſhall appear regular and in Proportion.

If it be required to delineate a monſtrous Projection on a Plane, proceed thus:

1. Make a Square $ABCD$, Fig. 1. (called the *Craticular Prototype*) of a Bigneſs at Pleaſure, and divide the Side AB into a Number of equal Parts, that ſo the ſaid Square may be divided into a Number of *Areola's*, or leſſer Squares.

2. In this Square, let the Image to be repreſented deform'd, be drawn.

3. Draw the Line $abc = AB$, (Fig. 2.) and divide it into the ſame Number of equal Parts, as the Side of the *Prototype* AB is divided into.

4. In E, the Middle thereof, erect the Perpendicular EV, ſo much the longer, as the Deformation of the Image is to be greater.

5. Draw VS perpendicular to EV, ſo much the leſs in Length, as you would have the Image appear more deform'd.

6. From each Point of Diviſion draw ſtreight Lines to V, and joint the Points a and S, as alſo the *Right-line* aS.

7. Through the Points $defg$, draw Right-lines parallel to ab; then will $abcd$ be the Space that the monſtrous Projection is to be delineated in, called the *craticular Ectype*.

8. In every *Areola*, or ſmall *Trapezium* of this Space $abcd$, let there be drawn what appears delineated in the correſpondent *Areola* of the Square $ABCD$, and by this Means you will obtain a deformed Image, which will appear formous to an Eye diſtant from it by the Length FV, and rais'd above it the Height VS.

9. It will be very diverting to manage it ſo, that the deform'd Image does not repreſent a mere Chaos, but ſome other Image different from it, which by this Contrivance ſhall be deform'd; as has been ſeen a River, with Soldiers, Waggons, *&c.* marching along the Sides of it, ſo drawn, that when it is look'd at by an Eye in the Point S, appears to be the ſatyrical Face of a Man.

10. An Image may be deformed mechanically, if you place the Image, having little Holes made in it here and there with a Needle or Pin, againſt a Candle or Lamp, and obſerve where the Rays, going through theſe little Holes, fall on a plain or curve Superficies; for they will give the correſpondent Points of the Image deform'd, by which Means the Deformation may be compleated.

To draw the Deformation of an Image upon the convex Surface of a Cone.

From the laſt Problem it is manifeſt enough, that all that is to be done here, is to make the *craticular Ectype* in the Superficies of the Cone, which ſhall appear to an Eye duly plac'd over the Vertex of it, equal to the *craticular Prototype*. Therefore,

1. Let the Baſe $ABCD$ of the Cone (*Fig.* 3.) be divided by Diameters into any Number of equal Parts; that is, let the Periphery be thus divided.

2. Likewiſe let ſome one Radius be divided into equal Parts, and through each Point of Diviſion draw concentrick Circles; and thus ſhall the *craticular Prototype* be made.

3. With the Double of the Diameter AB, as a Radius, deſcribe the Quadrant EFG, (*Fig.* 4.) ſo that the Arch EG may be equal to the whole Periphery; then this Quadrant rightly folded up, will form the Superficies of a Cone, whoſe Baſe is the Circle $ABCD$.

4. Divide the Arch EG into the ſame Number of equal Parts as the *craticular Prototype* is divided into, and draw *Radii* from each of the Points of Diviſion.

5. Produce GF to I, ſo that $FI = FG$, and from the Center I, with the Radius IF, draw the Quadrant FKH, and from I to E draw the Right-line IE.

6. Divide the Arch KF into the ſame Number of equal Parts, as the Radius of the *craticular Prototype* is divided into, and draw *Radii* through each of the Points of Diviſion from the Centre I, meeting EF in 1, 2, 3, *&c.*

7. Finally, from the Centre F with the *Radii*, $F1$, $F2$, $F3$, *&c.* deſcribe concentrick Arches; thus will you have the *craticular Ectype*, whereof each *Areola* will appear equal to one another.

8. Therefore, if what is delineated in every *Areola* of the *craticular Prototype* be transferr'd into the *Areola's* of the *craticular Ectype*, the Image will be deform'd; but the Eye being duly rais'd over the Vertex of the Cone, will perceive it formous.

9. If the Chords of the Quadrants be drawn into the *craticular Prototype*, and Chords of their fourth Part in the *craticular Ectype*, all things elſe remaining the ſame, you will have the *craticular Ectype* in a quadrangular Pyramid; and from hence you may learn how to deform an Image in any other Pyramid, whoſe Baſe is any regular Polygon.

10. Becauſe the Eye will be more deceiv'd, if from contiguous Objects it cannot judge of the Diſtance of the Parts of the deformed Image: Therefore theſe Kind of deformed Images muſt be looked at through a ſmall Hole.

To delineate a Figure in an Horizontal Plane, which ſhall appear by Reflexion on a Cylindrical Speculum *ſtanding on that Plane; like a Square divided into many little ſquare* Areola's.

1. About $A B$ (*Fig.* 5.) the Diameter of the Cylindrical *Speculum*, deſcribe a Circle equal to the Baſe of the Cylinder.

2. Take the Point O under the Eye, and draw the Tangents $O S$, $O T$, becauſe no Ray reflected from the *Speculum* beyond them, will fall upon the Eye. Likewiſe the Right-lines $O B$, $O A$, may be drawn ſo as to cut the Circle, ſince what are perceived by the Tangents will not be diſtinct enough.

3. Join the Points of Contact, or Interſection, $A B$ by a ſtreight Line $A B$, which muſt be taken for the Side of the Square appearing in the *Speculum*, becauſe the Image appears in a Cylindrical *Speculum* between the Centre and the Superficies.

4. Divide $A B$ into any Number of equal Parts, and from each of the Points of Diviſion 1, 2, 3, *&c.* draw Right-lines O 1. O 2, O 3, *&c.* to the Point O under the Eye.

5. Let the *Radii* $O H$, $O I$, be reflected to the Points $F G$, that is, let $H F$, $I G$, be the Reflexion of O 1, O 3.

6. Upon the indefinite Right-line $M Q$ (*Fig.* 6.) raiſe the Perpendicular $M P$ equal in Length to the Height of the Eye.

7. From M to Q transfer the Line $O H$, and at Q raiſe the Perpendicular $Q R$, which let be equal to the Side of the Square appearing in the *Speculum*, and divide the ſame into the ſame Number of equal Parts as that Side is divided into.

8. Through every Point of Diviſion 1, 2, 3, *&c.* draw the Right-lines P I, P. II, P III, *&c.*

9. From Q to I, II, III, *&c.* transfer the Right-lines Q I, Q II, Q III, *&c.* equal to Q I, Q II, Q III, *&c.*

10. After the ſame Manner, let the Lines $H F$, $I G$ be divided, and through the Points of Diviſion of the ſame Order draw Curves; or, ſince there is no Need of very great Accuracy in theſe Caſes, draw circular Arches through three Points, as is done in the Figure.

I ſay, the Figure $S T E G A$ being erected upon the Circle $A C D B$, will appear in the cylindrical *Speculum*, as a Square divided into ſeveral equal ſquare *Areola's*; whence if a Square be made whoſe Side is equal to $Q R$, and the ſame be divided into equal *Areola's*, and in the ſame be painted any Image, and then what is in every *Areola* of it be transferred in the Correſpondent *Areola's* of the deform'd Square, that deform'd Image will by Reflexion appear formous in the cylindrical *Speculum*.

To delineate a deform'd Figure upon an Horizontal Plane, that ſhall appear formous by the Reflexion of a Conical Speculum, *to an Eye over the Vertex.*

1. The Image to be deformed muſt be delineated in a Circle equal to the Baſe of the Conical *Speculum*, and the Periphery muſt be divided into equal Parts by the Diameters $a d$, $b e$, $c f$, *&c.* (*Fig.* 7.) and the *Radii* $O b$, $O c$, $O d$, *&c.* into equal Parts $O a$, 1. 2, 2. 3, *&c.* by concentrick Circles.

2. To get the Points I, II, III, *&c.* in the Plane that the Cone's Baſe ſtands upon, which are ſeen by reflected Rays within the *Speculum* at the Points 1, 2, 3, *&c.* make a Right-angled Triangle A, O, E, (*Fig.* 8.) whoſe Baſe $O E$ is equal to the Radius of the *Speculum*, and Altitude $A O$ equal to the Height of the *Speculum*, that is, equal to its Axis; and in $A O$ produced take $A B$ equal to the Height of the Eye.

3. To every of the Points 1, 2, 3, *&c.* of Diviſion from the Point B, wherein the Eye is ſuppoſed, draw the Right-lines B 1, B 2, B 3, *&c.*

4. Becauſe theſe are the reflected Rays by which the Points 1, 2, 3, *&c.* are ſeen, and $A E$ is the Interſection of the Plane of Reflexion and the *Speculum*, make the Angles $I D E$, II. $G E$, equal to the Angles $B D A$, $B C A$, *&c.* then ſhall D I, C II, *&c.* be the Rays of Incidence: Conſequently, I, II, *&c.* the radiating Points which are ſeen by Reflection, in 1, 2, 3, *&c.*

5. Therefore produce the *Radii* $O a$, $O b$, $O c$, *&c.* (*Fig.* 9.) in the *craticular Prototype*, and transfer in them the Diviſions O I, O II, O III, *&c.* And laſtly, draw concentrick Circles from the Point O; and thus will you have the *craticular Ectype.*

6. Therefore, if in every of its *Areola's* you depict what you find in the correſpondent *Areola's* of the *craticular Prototype*, you will have a deform'd Figure, which will appear formous by Reflexion to an Eye duly plac'd over the Vertex of the Cone.

To delineate a deform'd Image upon a Plane, that ſhall appear formous by Reflection to an Eye placed over the Vertex of a pyramidal Speculum.

For *Example.* Let it be required to delineate a deform'd Image, which will appear formous by the Reflexion of a Quadrangular Pyramid.

1. In this Caſe, the Image to be deform'd is to be delineated in the Square $A B C D$, (*Fig.* 10.) equal to the Baſe of the *Speculum*, whoſe Perimeter muſt be divided into equal Parts by Diagonals from the Centre E, and alſo by Right-lines biſecting the Sides $A B$, $B C$, *&c.* Moreover, the Lines $E L$, $E B$, muſt be divided into any Number of equal Parts; ſo that the Lines drawn through the Points of Diviſion, which are parallel to the Sides of the Baſe, may include the *craticular Prototype.*

2. Now, ſince the Section of the *Speculum* thro' the Axis, and the Right-line $E L$ drawn in the Baſe, is a Right-angled Triangle, and every Point of Diviſion of the *craticular Prototype* is in the reflected Ray, after the very ſame Manner as in the laſt Problem are found the Points I, II, III, *&c.* of the Axis $L E$ of the Triangle $B E C$, to be reflected; which being given, the Triangle it ſelf may be made.

3. Laſtly, What elſe is to be done, muſt be proceeded with as in the laſt Problem.

Note, Deform'd Images that are made by Means of pyramidal *Speculums*, are more diverting than thoſe made by others; becauſe the Parts of the deformed Image being disjoined, any others may be painted between them, forming one and the ſame continuous thing with them without the *Speculum*, which in the *Speculum* will not be ſeen.

ANAPÆST, is a *Latin* Verſe, whoſe Feet conſiſt of three Syllables, the laſt long, and the two firſt ſhort. Such Verſes are called

ANAPÆSTICK VERSES; they are commonly uſed in Tragedies, where are three Feet, which are uſed in all Parts of the Verſe indifferently; as,

Caſtos ſequitur mala paupertas,
Titioque potens regnat Adulter.

Place this und.r the Word Anotomy

Fig. 1

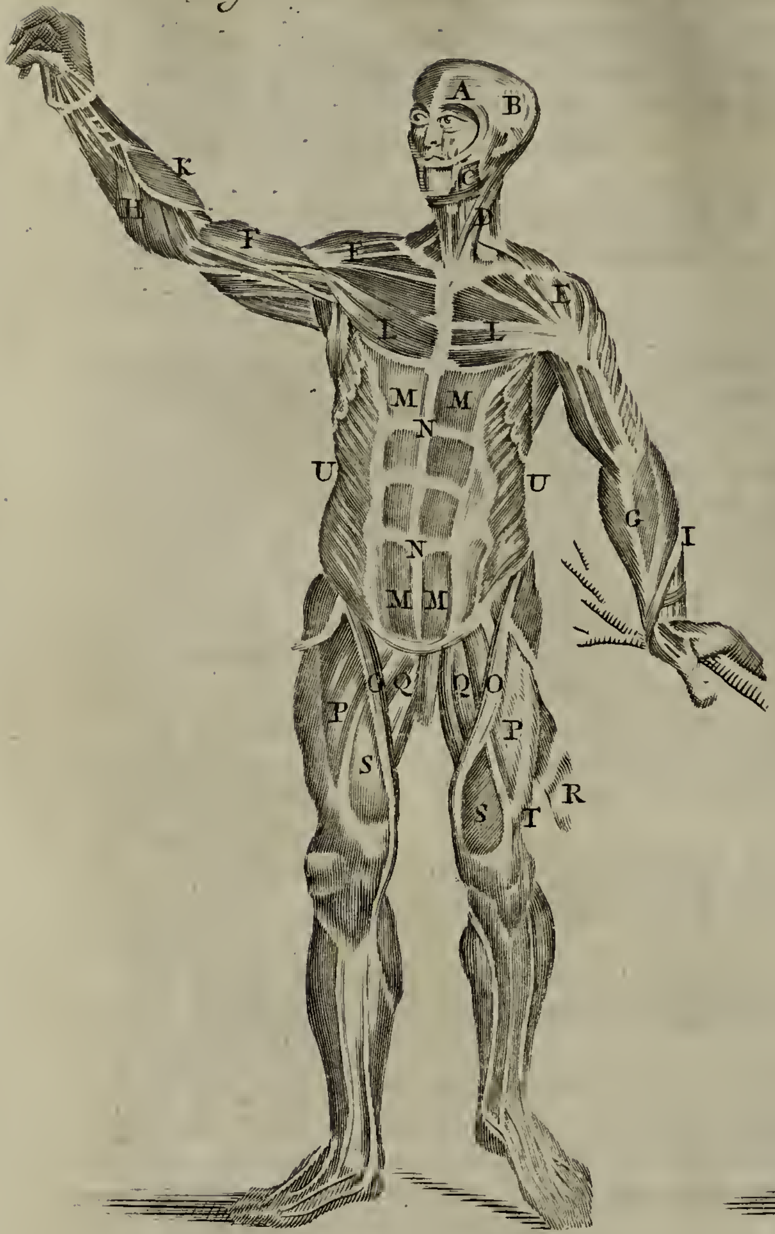


Fig. 2

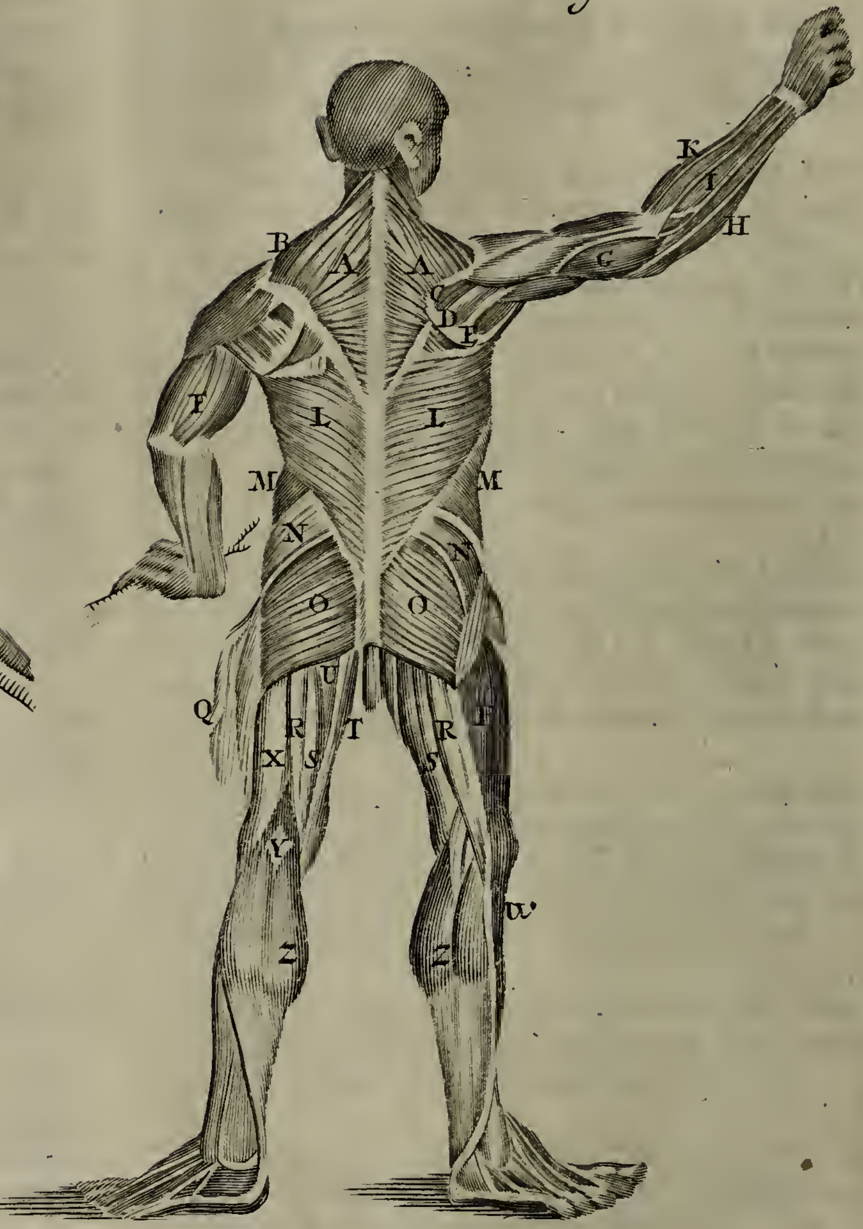


Fig. 3

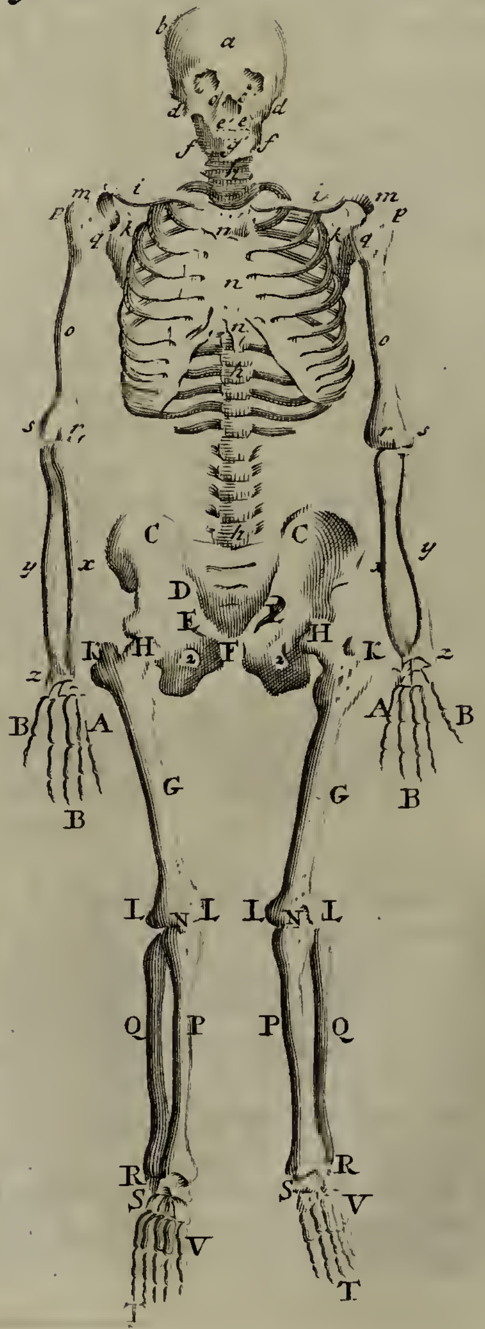
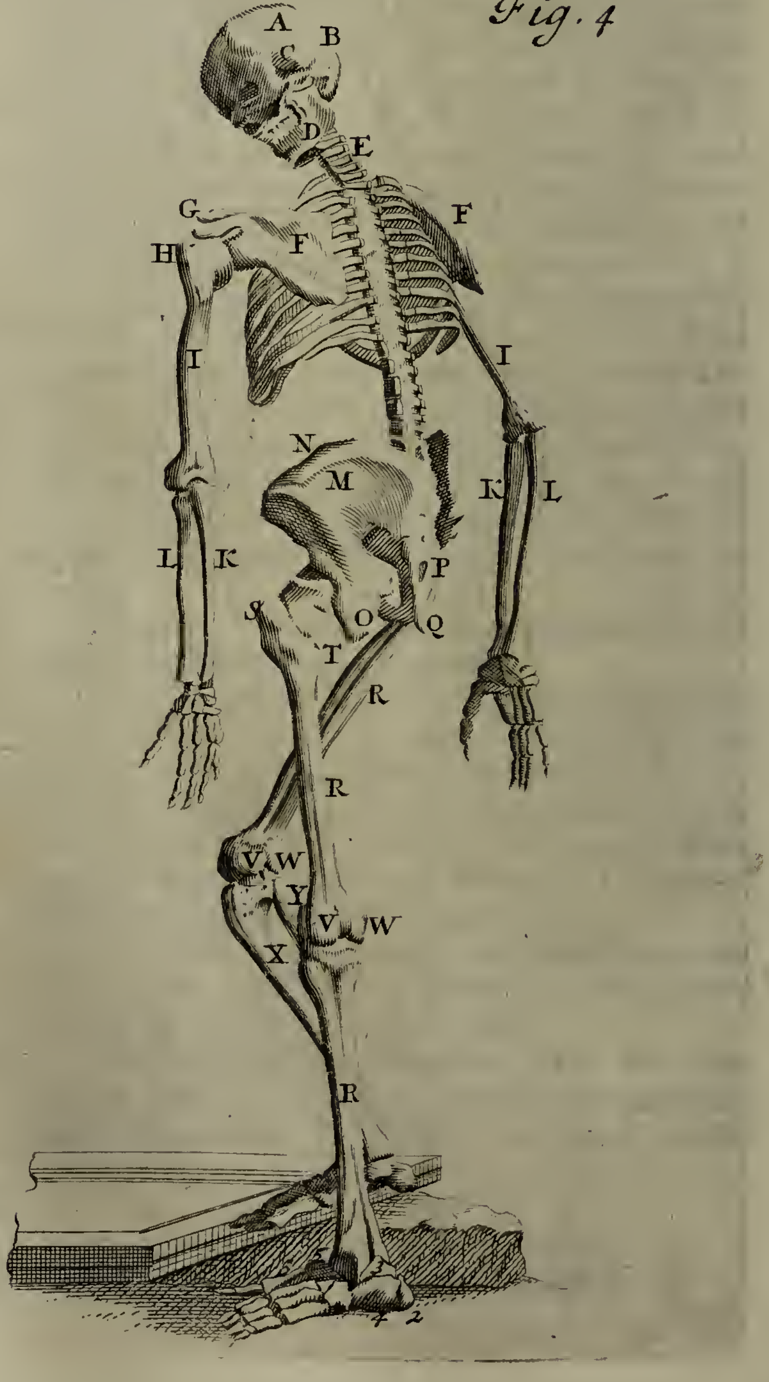


Fig. 4



ANAPHORA, [in the *ancient Aſtronomy,*] an Aſcenſion or Riſing up of the 12 Signs of the Zodiack from the Eaſt by the daily Courſe of the Heavens.

ANAPHORA, (a Figure in *Rhetorick,*) is the Repetition of the ſame Sound in the Beginning of ſeveral Sentences or Verſes.

ANAPLEROTICK *Medicines,* ['Αναπληρωτικὰ, of *ἀναπληρόω, Gr. to fill up,*] are ſuch as help to fill Ulcers with Fleſh.

ANARCHY, ['Αναρχία, of ἀνὰ and ἀρχὴ, *a Chief or Head,*] Want of all Government in a Nation where there is no ſupreme Authority lodged in either Prince or Rulers; but the People live without any Rule or Government at all, and all things are in the utmoſt Confuſion.

ANARETA, [in *Aſtrology,*] the fatal Planet, the Threatener of Death in a Nativity.

ANASARCHA, ['Ανασάρκα, *Gr.*] is a white, ſoft, yielding Tumour of the whole outward Body, or of ſome of its Parts, which dents in by compreſſing the Fleſh; it is cauſed by the Blood upon a double Account; firſt, when it doth not rightly ſanguifie or aſſimilate the Chyle; and again, when it is not rightly accended in the Lungs; the Blood thus perverted, pours forth the *Serum* at the Extremities of the Arteries in greater Quantities than it can receive and reduce by the Veins and Lymphe-ducts, or expel by the Veins and Pores, and other Paſſages that ſend it forth. If the Humours be too viſcous, it is called *Leucophlegmatia. Blanchard.*

ANASTOMATIQUE *Medicines,* ['Αναστομωσις, of *ἀναστομόω, Gr. to open or unſtop,*] are ſuch as open and dilate the Orifices of the Veſſels, and by that Means help to make the Blood circulate freely, and paſs eaſily out of the Arteries into the Veins.

ANASTOMOSIS, is an Effluxion of the Blood, the Lympha or Chyle, at the Meeting of Veſſels that cloſe not narrowly: It is alſo taken for the mutual opening of Veins and Arteries into one another.

ANASTROPHE, a Figure in Grammar, when the Word which ſhould follow is ſet foremoſt, as *Italiam contra.*

ANATASIS, an Extenſion upwards; with *Surgeons,* an Extenſion of the Body towards the upper Parts.

ANATOCISM, [Ανατοκισμὸς, *Gr.*] is the annual Increaſe of Intereſt of Money, whether Simple or Compound. And under it they alſo comprehend the Valuation of Annuities. See *Intereſt.*

To ANATOMIZE, ['Ανατέμνω, *Gr.*] to cut up, to cut to Pieces, to diſſect an animal Body, in order to view the Parts of it.

ANATOMY, [*Anatomia, L.* of 'Ανατομὴ, of *ἀνατέμνω, Gr. to cut in Pieces,*] a curious, dextrous, and neat Diſſection, or the taking to Pieces the ſolid Parts of an animal Body, in order to diſcover its ſeveral Parts, for the explaining their Original, Nature, and Uſe; for the better Improvement of the Practice of Surgery, Phyſick, and Natural Philoſophy.

Hippocrates, Democritus, Ariſtotle, Galen, and others of the Ancients, eſteemed *Anatomy* as the moſt important Part in Phyſick, and that without a Knowledge in it, the Uſes of the Parts of a natural Body, and conſequently the Cauſes of Diſeaſes incident to it, could no ways be diſcovered. But however uſeful this Art is, it lay neglected for ſeveral Ages, till the 16th Century, when it began to come into Repute again; before which Time, the Diſſection of a human Body was looked upon as Sacrilege: Nay, even at this Time, the Uſe of *Anatomy* and *Skeletons* is forbidden in *Muſcovy*; the former as inhuman, and the latter as ſubſervient to Witchcraft.

The firſt Perſon who ſet *Anatomy* upon any tolerable Foot again, is ſaid to be *Veſalius,* a *Flemiſh* Phyſician, about the Year 1550. Several followed his Tract, as *Carpus, Sylvius, Fernelius, Euſtathius, Fallopius, Fabricius Parcus, Banlinus, Hoffman, Riolanus,* &c.

Others ſucceeded the before-mentioned, to which the fineſt Diſcoveries in Anatomy are owing. The Lacteal Veins were diſcovered by *Aſellius* in the Year 1622; and *Harvey* publiſhed his admirable Diſcovery of the Circulation of the Blood in the Year 1628. The Reſervoir of the *Chyle* and *Thoracick Duct* were diſcovered in 1651. The *Lymphatick Veſſels* were diſcovered by *Rudbecks* and *Bartholinus,* about the Year 1650 and 1651. The Diſcovery of the *Lower Salival Veſſels* is owing to *Wharton* in 1655; and that of the *Salival Ducts,* the *Palate,* the *Noſtrils,* and the *Eyes,* to *Stene,* in the Year 1661. Of the *Pancreatick Ducts* to *Wirtſungus* in 1642; afrer him *Willis* publiſhed an *Anatomy of the Brain,* which was afterwards improved by *Vicuſſeus.*

Gliſſon wrote particularly of the *Liver*; *Wharton* of the *Glans*; *Havers* of the *Bones*; *Graaf* of the *Pancreatick Juice,* and the Parts of Generation; *Lower* of the Motion of the *Heart*; *Thurſton* of *Reſpiration*; *Peyer* of the Glands of the *Inteſtines*; *Brown* of the *Muſcles*; *Drelincourt* of the Conception of the *Ova* in Women, the *Placenta,* and the Membranes of the *Fœtus.*

But *Anatomy* owes not to any ſo much as to *Malpighius,* who died in the Year 1694, who made many Diſcoveries in the *Brain, Glands, Lungs, Liver, Spleen, Lymphaticks,* &c. by the Help of a Microſcope, *&c.* and great Light into many of the finer and more intricate Parts of the human Structure has been let in by *Ruyſch,* ſtill living; and particularly of the *Glands* by Means of Injections.

ANATOMY, in Reſpect to its Subject, is divided into *Human* and *Comparative.*

Human ANATOMY, is that which is employed on the human Body.

Comparative ANATOMY, is that which is employed upon Bruits, and other Animals, and even upon Vegetables; the firſt chiefly with a View to illuſtrate the human Structure; the latter for the better Cultivation and Propagation of, as well as curing and preventing the Diſeaſes of Plants.

ANATOMY, [of *Plants,*] conſiſts in the Knowledge of the Structure of the ſeveral Parts of them, as the Root, the Bark, the Pith, the Wood, the Leaf, the Flower, *&c.*

The *Roots* of Plants are diſcovered to be ſpongeous Bodies, whoſe Parts are diſpos'd for the Admittance of certain humid Particles in the Earth. *Boerhaave* conſiders the Roots of Plants as compos'd of a Number of abſorbent Veſſels analogous to the Lacteals in Animals; and Mr. *Reneaume* imagines, that Roots do the Office of all the Parts of the *Abdomen* of a human Body, which miniſter to Nutrition, as the Stomach, Inteſtines, *&c.*

The *Bark* is of a ſpongy Contexture, and communicates with the Pith by many *Fibrillæ,* that paſs through the little Tubes of which the Wood conſiſts; ſo that the Root having imbibed the proper Nutriment of the Tree, it is by Means of the Warmth of the Soil, *&c.* carried up through the fine arterial Veſſels of it to the Top of the Plant; where being condenſed by the cold Air, it returns by its own Gravity down the Veſſels which lie between the Wood and inward Bark, which do the Office of Veins, and as it paſſes by, leaves ſuch Parts of its Juice as the Texture of the Bark is adapted to receive, and requires for its Support.

Pith conſiſts of ſmall tranſparent Globules, concaterated ſomething like the Bubbles, which compoſe the Froth of the Liquor, and is the inward or central Part of a Tree or Plant, and is ſuppos'd to be analogous to the *Medulla* or Marrow of an Animal.

The *Wood* has been, by the Help of a Microſcope, diſcovered by Doctor *Grew*, to be only an Aſſemblage of infinite minute Canals, or hollow Fibres, ſome of which ariſe from the Root upwards, and are diſpos'd in Form of a Circle; and alſo others which he calls *Inſertions*, which tend horizontally from the Surface to the Centre; ſo that they croſs each other, and are interwoven like the Threads of a Weaver's Webb.

So that the *Wood* conſiſts of capillary Tubes, running parallel from the Root throughout the Stalk. The Apertures of theſe little Tubes are commonly too ſmall to be perceived by the Eye, except in a Piece of Cane, Charcoal, or the like.

Theſe *Tubes* are by ſome called *arterial Veſſels*, being thoſe in which the Sap riſes from the Root.

On the Outſide of theſe *arterial* Veſſels, between the Wood and the inner Bark, are other larger Veſſels, called by ſome *venal Veſſels*, ſuppoſed to contain the Liquid Sap found in Plants in the Spring.

Leaves. Dr. *Grew* obſerves ſix ſeveral Parts intended by Nature for the Preſervation of Gems, *viz.* Leaves, Sunfoils, Interfoils, Stalks of Leaves, Hoods, and Mantlings, that cover them.

The *Skin*, or Coats of the Leaves, is no more than that of the Branches extended, as Gold by beating is reduced into Leaves.

They are folded ſometimes in two, and ſometimes into ſeveral Plaits in the Gem, ſomething after the Manner of a Fan.

A Deſcription of the Anatomical Plate.

Figure I.

Repreſenting the Muſcles of the Fore Part of an human adult Body.

a the *Muſculus Frontalis.*
b the *Temporalis.*
c the *Muſculus* called *Maſſeter.*
d the *Deltoides.*
f the *Biceps.*
g the *Extenſor Carpi.*
h the *Flexor Carpi.*
i the *Extenſor tertii Internodii Pollicis.*
k the *Flexor Pollicis.*
l l the *Muſculi pectorales.*
m m the *Muſculi recti* of the *Abdomen.*
n n the *Linea alba.*
u u the *Muſculi obliqui deſcendentes* of the *Abdomen.*
o o the *Muſculus ſartorius*, or *Faſcialis.*
p p the *Muſculi recti Femoris.*
q q the *Triceps.*
r Part of the *Muſculus membranoſus.*
s s the *Vaſtus internus.*
t the *Vaſtus externus.*

Figure II.

Repreſenting the Muſcles of the Hinder Part of the Body.

a a the *Trapezius Muſculus.*
b the *Deltoides.*
c the *Supra Spinatus.*
d the *Infra Spinatus.*
e the *Teres major.*
f the *Extenſor Brachii.*
g the *Muſculus Brachialis.*
h the outward *Extenſor Carpi.*
i the other *Extenſor Carpi.*
k the *Muſculus Radii longus.*
l l the *Latiſſimus Dorſi.*
m m the *Muſculi obliqui deſcendentis Abdominis.*
n the *Muſculus Quadratus.*
o o the *Glutæus maximus.*
p the *Vaſtus externus.*
q Part of the *Membranoſus.*
r r the *Seminervoſus.*
s s the *Semimembranoſus.*
t the *Gracilis.*
u the *Triceps.*
x the *Biceps.*
y the *Subpoplitæus.*
z z the *Gaſterocnemii.*
w the *Peronæus.*

Figure III.

Repreſenting the Skeleton of an adult human Body on the Fore-ſide.

a the *Os Frontis.*
b the *Os Temporis.*
c c the *Oſſa Naſi.*
d d the *Oſſa Jugalia.*
e e the Bones of the upper Jaw.
g the Teeth.
f f the Bones of the lower Jaw.
h h h the *Vertebræ* of the *Neck*, *Thorax*, and *Os Sacrum.*
i i the *Claviculæ.*
k k the *Scapulæ.*
l the Articulation of the *Scapulæ*, with the *Os Humeri.*
m m the ſecond Proceſs of the *Scapulæ*, called *Acromium.*
n n n the Bones of the *Sternum.*
o o o the *Os Humeri.*
p p the upper and outer Head of the *Os Humeri*, which ſerves to implant the Ligaments upon.
q q the upper and inward Head of it, which articulates with the *Scapula.*
r r the innermoſt Head of its lower *Appendix*, which receives the *Ulna.*
s s the outer Head of the ſame *Appendix*, which receives the *Radius.*
x the *Ulna.*
y the *Radius.*
z z the eight Bones of the *Carpus.*
A A the four Bones of the *Metacarpus.*
B B the four Fingers and Thumb, each conſiſting of three Bones.
C C the *Os Ilium.*
D the *Coxendix.*
E the *Os Sacrum.*
F the *Os Pubis.*

G G the *Os Femoris.*
H H the upper Head of it, which is received into the *Acetabulum* of the *Coxendix.*
K K the outer *Trochanters.*
L L the two lower Heads of the Thigh Bone.
N N the *Patella.*
P P the *Tibia.*
Q Q the *Fibula.*
R R the *Talus.*
S S the *Os naviculare.*
V V the five Bones of the *Tarſus.*
T T the fourteen Bones of the Toes.
z z The *Foramina* of the *Os Iſchium* and *Pubis.*

Figure IV.

Repreſenting the Back Side of an human adult Skeleton.

a the *Os Sincipitis.*
b the *Os Occipitis.*
c the *Os ſquammoſum.*
d the lower Jaw.
e the *Vertebræ* of the Neck.
f the *Scapulæ.*
g the *Spina Scapulæ.*
h the outward Head of the *Os Humeri.*
i the *Os Humeri.*
k k the *Radius.*
l l the *Ulna.*
m the Back or the *Os Ilium.*
n the Spine of the *Ilium.*
o the Protuberance of the *Os Iſchium*, whence the Muſcles ariſe which bend the Leg.
p the *Os ſacrum.*
q the *Os Coccygis.*
r r the *Os Femoris.*
s the *Trochanter major.*
t the *Trochanter minor.*
u u *w w* the two inferior Protuberances of the lower Appendix of the *Os Femoris.*
x the *Tibia.*
y the *Fibula.*
2 the *Os Calcis.*
3 the *Os Aſtragali.*
4 the *Os Cuboides.*
5 the three *Oſſa cuneiformia.*
6 the *Oſſa Metatarſi.*

ANCESTOR. The Law diſtinguiſhes between *Anceſtor* and *Predeceſſor*, the former being applied to a natural Perſon, as *A B* and his Anceſtor; the latter to a Body politick or corporate, as a Biſhop and his Predeceſſors.

Tho' the Word *Anteceſſor*, whence *Anceſtor* is derived, is not applied to the *Anceſtor* of a Family, but to the Prepoſſeſſor of an Eſtate, or a Predeceſſor in Office. *Anceſtrel* Homage, is ſuch Homage as hath been performed by our *Anceſtors.*

ANCHILE, [Ἀγχυλὴ, *Gr.*] is the back Part of the Knee; alſo the Contraction of a Joint, eſpecially of the *Ham.*

ANCHOR *of a Ship*, is a thing as well known as the Ship it ſelf, and alſo its Uſe; but the Terms of Art uſed at Sea about its ſeveral Parts, Kinds, and Uſes, are as followeth.

The Parts of an *Anchor* are, 1. The *Ring*, into which the Cable is faſtened. 2. The *Beam* or *Shank*, which is the longeſt Part of the Anchor. 3. The *Arm*, which is that which runs down into the Ground; at the End of which is, 4. The *Flouk* or *Fluke*, by ſome called the *Palm*, being that broad and pecked Part, with its Barbs, like an Arrow-head, which faſtens into the Ground. 5. The *Stock*, a Piece of Wood faſtened unto the Beam near the Ring, ſerving to guide the *Fluke*, ſo that it may fall right and fix in the Ground. There are three Kinds of Anchors, the *Kedger*, the *Grapnel*, and the *Stream Anchor*, (*which ſee under thoſe Words*). The Anchors on board a Man of War are, the firſt, ſecond, and third Anchors; two of which being always carried at the Bow of the Ship, are therefore called the *firſt* and *ſecond* Bower; the other, which is the largeſt of all, is called the *Sheet Anchor*, and is their utmoſt Refuge, when in a great Streſs of Weather they are forced to ride on a *Lee-Shore.*

When the Cable is perpendicular between the *Hawſe* and the *Anchor*, the *Anchor* is then ſaid to be *a-peek.* When the Anchor hangs right up and down by the Ship's Side, it's ſaid to be a *Cock-bell* upon the Ship's coming to an Anchor. To put an Anchor down into the Sea, in order to make the Ship *ride*, is called *letting fall* or *dropping the Anchor.* They ſay *an Anchor is foul*, when by the turning about of the Ship the Cable is hitched about the *Fluke.* An *Anchor* is ſaid *to come home*, when it cannot hold the Ship, but that ſhe drives away by the Violence of the Wind or Tide. To *ſhooe an Anchor*, is to put Boards fitted and formed for that Purpoſe on upon the *Flukes*, that the Anchor may hold the better in ſoft Ground.

The Shank of an Anchor is to be three times the Length of one of its *Flukes*; and a Ship of 500 Tons hath her Sheet Anchor of 2000 Weight; and ſo proportionably for others ſmaller or greater.

ANCHORAGE, [in *Law*,] is a Duty taken of Ships for the Pool of the Haven where they caſt Anchor; for no Man can let any Anchor fall on the King's Ground in any Port, without paying for it to the King's Officer appointed by Patent.

ANCHORING, or *Anchorage*, is Ground fitting to hold a Ship's Anchor, that ſo ſhe may ride it out ſafely: The beſt anchoring Ground is ſtiff Clay or hard Sand; and the beſt Riding at an Anchor, is when a Ship is land-lockt, and out of the Tide.

ANCHORS, [in *Architecture*,] is a certain kind of Carving, in the Form of an Anchor or Arrow Head, which is placed by way of Ornament to the *Boultins* of Capitals of the *Tuſcan*, *Dorick*, and *Ionick Orders*; and alſo to the *Boultins* of Bed-Mouldings, of the *Dorick*, *Ionick*, and *Corinthian* Corniſhes. The Anchors and Eggs being placed alternately.

ANCHYLOPS, [Ἀγχύλυψ, *Gr.*] the ſame with *Ægylops*; which ſee.

ANCIENT, is the Flag or Streamer in the Stern of a Ship.

ANCIENT *Demeſne*, or *Demayn*, is a certain Tenure whereby all Manors belonging to the Crown in St. *Edward*'s or *William the Conqueror*'s Time were held. The Numbers and Names, &c. of ſuch Manors, were entred by the Conqueror in a Book called *Doomſday Book*, and now remaining in the *Exchequer*; ſo that ſuch Lands as by that Book appeared to have belonged to the Crown at that Time, are called *Ancient Demeſne.* The Tenants in *Ancient Demeſne* are of two Sorts; one that hold their Lands frankly by Charter, the other by Copy of Court-Roll, or by the Verge at the Will of the Lord, according to the Cuſtom of the Manor

Manor. The Advantages of this Tenure are, 1. That Tenants holding by Charter cannot be rightly impleaded out of their Manor; and when they are, they may *abate* the Writ by pleading the Tenure. 2. They are free from Toll for all things relating to their Livelihood and Husbandry; nor can they be impannelled upon any Inqueſt.

ANCON, } [Ἀγκὼν, *Gr.*] in *Surgery*, is the
ANCOME, } Top or Point of the Elbow, and is taken alſo ſometimes for the backward and larger ſhooting forth of the *Ulna.*

ANCONES, [in *Architecture*,] the Coins or Corners of Walls ſuch as Meetings or Bowings of Elbows, croſs Beams, Rafters, *&c.*

ANCONÆUS, a Muſcle of the *Cubit*, called ſo by *Riolanus*, from its Situation. It ariſeth fleſhy from the inferior and back Part of the *Os Humeri*, growing larger as it marcheth between the ſuperior Ends of the *Ulna* and *Radius*, and is inſerted fleſhy to the lateral Part of the *Brachiæus externus*, a Thumb's Length below the *Olecranum.* It helps to extend the Cubit.

ANCONY, is the Term in the Iron Works for a *Bloom*, wrought into the Figure of a flat Iron Bar of about three Foot long, with two ſquare rough Knobs, one at each End, which are afterwards to be wrought at the *Chafery.* See *Iron.*

ANCYLOBLEPHARUM, [Ἀγκυλοβλέφαρον, of ἀγκύλος, *crooked*, and βλέφαρον, *Gr. the Eyelids*,] is the growing of the Eye-lids to the *Tunica cornea*, or to the *Albuginea*, ſo that ſometimes both the Eye-lids grow together.

ANCYLOGLOSSUM, [Ἀγκυλόγλωσσον, of ἀγκύλος and γλῶσσα, *Gr. the Tongue*,] is when the little String under the Tongue is too ſtraitly tied, ſo that there is a Difficulty of uttering the Words.

ANCYROIDES, [Ἀγκυροειδής, of Ἄγκυρα, *an Anchor*, and εἶδος, *Form*, *Gr.*] the ſhooting forth of the Shoulder Bones in the Form of a Beak; which is called *Coracoides*, *Anchoralis*, and *Cornicularis.*

ANDRATOMY, [of ἀνὴρ, *gen. plur.* ἀνδρῶν, *Man*, and τομὴ, *a Cutting*, *Gr.*] is a Diſſection of human Bodies, as *Zootomy* is of thoſe of Beaſts.

ANDROMEDA, a Northern Conſtellation, conſiſting of 27 Stars.

ANDROGYNE, [Ἀνδρόγυνος, of ἀνὴρ, *a Man*, and γυνὴ, *a Woman*, *Gr.*] an Hermaphrodite, which is of both Sexes, or both Male and Female; the ſame with

ANDROGYNUS, an Hermaphrodite, or one who is caſtrate and effeminate.

ANEMIUS *Furnus*, [of Ἄνεμος, *Gr. the Wind*,] a Wind Furnace for ſtrong Fires, for Melting or Diſtillation.

ANEMOMETER, [of Ἄνεμος and μέτρον, *Gr. Meaſure*,] a Machine contrived for meaſuring the Strength of the Wind.

ANEMOSCOPE, [of Ἄνεμος, *the Wind*, and σκοπέω, *Gr. to view*,] a Machine invented to foreſhew the Change of the Air or Wind: I have obſerved that *Hygroſcopes* made of Cat's-gut, according to the Directions you will find under that Word) are very nice *Anemoſcopes*, and never fail hardly by their turning the Index about to foretel the ſhifting Wind. But, as *Vitrivius* deſcribes an *Anemoſcope*, it ſhews, that the Ancients rather deſigned it to ſhew which Way the Wind blew, than to foretel to what Quarter it would ſhift or change.

ANEURISM, [of Ἀνευρύνω, *Gr. to dilate*,] is a Diſeaſe, which is a Kind of Dilatation or burſting of the Arteries, always beating, and ſwelling ſometimes to the Bigneſs of an Egg, which yields, if you compreſs it, but recoils preſently.

The moſt accurate and learned Dr. *Tyſon* found in his Anatomy of the *Tajacu*, or *Aper Mexicanus*, ſeveral *Aneuriſmata* in the *Aorta*, or great Artery, which it ſeems were natural, and which he never ſaw before in the Arteries of any other Animal: Though *Malpighius*, as he obſerves, took Notice of ſuch in the *Aorta* of Silk-worms.

ANGARIA, (a Term in *Law*,) ſignifying any troubleſome or vexatious Duty or Service paid by the Tenant to the Lord.

ANGEL, the Name of a Gold Coin in *England*, which ſeems to be ſo called from the Figure of an Angel impreſs'd upon it: Its Value in 1 *H.* 6. was 6 *s.* 8 *d.* in 1 *H.* 8. 7 *s.* 6 *d.* in 34 *H.* 8. 8 *s.* in 6 *Ed.* 6. 10 *s.* and the *Half Angel*, or as it was ſometimes called the *Angelet*, was the Moiety of this. *Chron. Precioſ.*

ANGEIOGRAPHY, [of Ἀγγειογραφία, of ἀγγεῖον, *a Veſſel*, and γραφὴ, *Gr. Deſcription*,] a Deſcription of Veſſels in the human Body, *i. e.* the Nerves, Veins, Arteries, Lymphaticks, *&c.*

ANGEIOLOGY, [Ἀγγειολογία, of ἀγγεῖον and λέγω, *Gr.*] a Treatiſe or Diſcourſe of the Veſſels in a human Body.

ANGEIOTOMY, [of Ἀγγεῖον and τομη, *a Section*, of τέμνω, *Gr. to cut or divide*,] a cutting open the Veſſels of an animal Body, as a Vein or Artery.

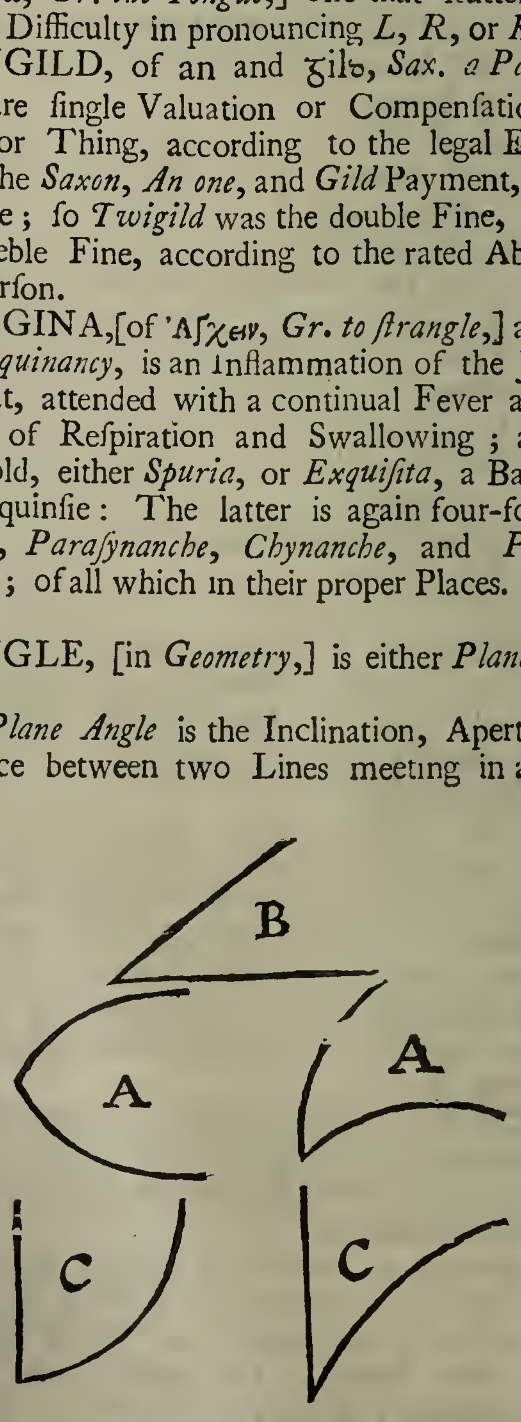
ANGIGLOSSUS, [Ἀγγιγλωσσοι, of ἀγγὺς, and γλωσσα, *Gr. the Tongue*,] one that ſtuttereth, or hath a Difficulty in pronouncing *L*, *R*, or *K*.

ANGILD, of an and ᵹilꝺ, *Sax. a Payment*,] the bare ſingle Valuation or Compenſation of a Man or Thing, according to the legal Eſtimate, from the *Saxon*, *An one*, and *Gild* Payment, Mulct, or Fine; ſo *Twigild* was the double Fine, *Trigild* the treble Fine, according to the rated Ability of the Perſon.

ANGINA, [of Ἄγχειν, *Gr. to ſtrangle*,] a *Quinſy* or *Squinancy*, is an Inflammation of the Jaws or Throat, attended with a continual Fever and Difficulty of Reſpiration and Swallowing; and it is two-fold, either *Spuria*, or *Exquiſita*, a Baſtard or true Squinſie: The latter is again four-fold; *Synanche*, *Paraſynanche*, *Chynanche*, and *Parachynanche*; of all which in their proper Places. *Blanchard.*

ANGLE, [in *Geometry*,] is either *Plane* or *Solid.*

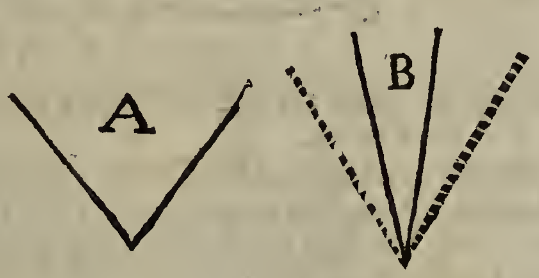
A *Plane Angle* is the Inclination, Aperture, or Diſtance between two Lines meeting in a Point, and which, when the Lines forming it (which are called



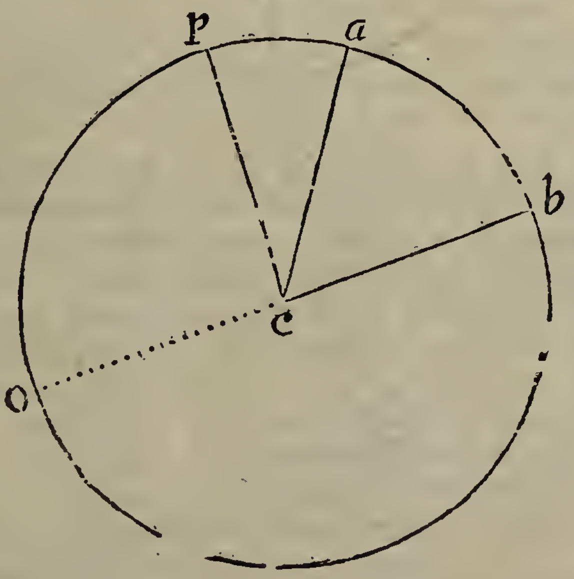
called its *Legs*) are right or ſtrait ones, is called a Right-lined or Rectilineal Angle, as *B*; but when the Legs are crooked Lines, it is called a Curvilineal Angle, as *A*; and when one Leg is ſtrait, and the other crooked, it is called a Mixt Angle, as *C*.

An *Angle* is uſually marked with three Letters, (eſpecially if there be more Angles than one at the ſame Point) wherefore the middle Letter, which is always placed at the angular Point where the Lines meet, denote the Angle.

The *Quantity*, *i. e.* the Greatneſs or Smallneſs of an Angle, is by no Means meaſured by the Length of its Legs, but by their Diſtance from, or Inclination to each other. Thus the Angle *B* is leſs than *A*, tho' the Legs of *B* are much longer than thoſe of *A*; but then thoſe of *B* are more inclined to each other, than the Legs of the Angle *A*; which to conceive the better, imagine the Angle *A* to be laid upon *B*, as the prick'd Lines about *B* do repreſent; then it is plain, the Angle *B* will eaſily be contained within *A*; and therefore is *leſs* than *A*, becauſe its Legs come nearer, or are more inclined towards each other, than thoſe of *A*; and conſequently *A* will be a *greater* Angle than *B*, becauſe its Legs are farther diſtant from each other than the Legs of *B*. If you imagine the Legs to open and ſhut like thoſe of a Joint Rule, or a Pair of Compaſſes, the Thing will be very plain.



The Quantity of any Angle is meaſured by the Number of Degrees of the Ark of a Circle intercepted between the Legs of the Angle, whoſe Centre is the angular Point. Thus the Ark *a b* is the Meaſure of the Angle *a c b*; and if that Ark contain 30 Degrees, the Angle is ſaid to be an Angle of 30 Degrees.



A *Rectilineal* ANGLE is of three Sorts.

1. *Right*, when one Leg of the Angle ſtands exactly upright, or perpendicularly on the other, as *p c* doth on *c b*; and inclines no more one Way than it doth another. And ſuch a Right Angle is ſaid to be an Angle of 90 Degrees, becauſe it is meaſured by an Ark, that is, the fourth Part of a Circle (as you ſee in the laſt Figure) and every Circle being ſuppoſed to have its whole Circumference divided into 360 Parts, (which are called *Degrees*) the fourth Part of that is 90 *Deg.* and therefore a Right Angle contains 90 *Deg.*

2. An *Obtuſe Angle*, as *a c o*, which exceeds, or is bigger than a Right one, and is called *Obtuſe*, becauſe its angular Point is blunt.

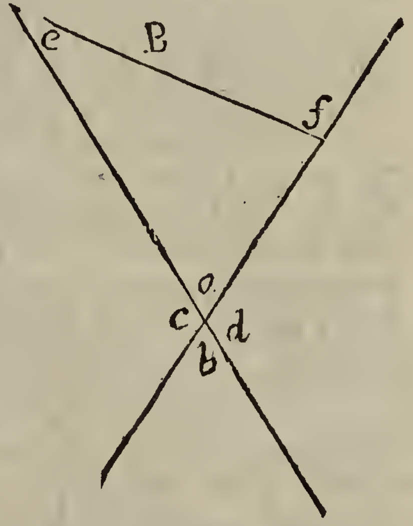
3. An *Acute Angle*, as *a c b*, which is leſs than a Right one, and is called *Acute*, becauſe its angular Point is ſharp. No Angle can contain fully 180 Degrees, for then one Leg falls into the ſame Right Line with the other, and they make the Diameter of the Circle *o b*.

Angles alſo receive ſeveral other Denominations, according to their ſeveral Poſitions, their Relation to the ſeveral Figures they are in, and the Lines that form them. Some are called,

1. *Contiguous* or *adjacent Angles*, as *a* and *c*, *c* and *b*, *a* and *d*, &c. which have one Leg common to both Angles, and are both taken together, always equal to two Right ones; for if they are equal, the Obtuſe one will be as much bigger than a Right one, as the Acute one is leſs; and therefore in the whole muſt make juſt two Right. 13 *e* 1 *Euclid*.

> *Cor.* And from hence 'tis plain, that all the Angles that can be made about any Point, are equal but to four Right ones.

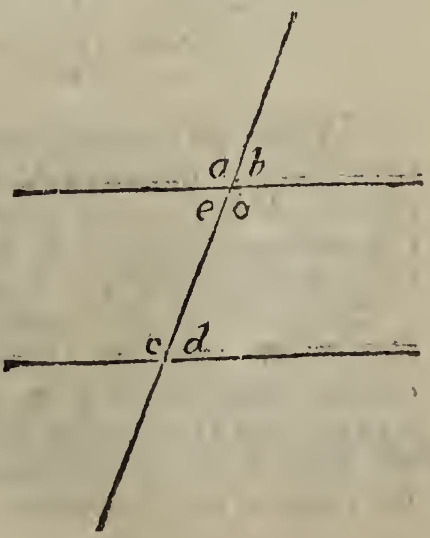
2. *Oppoſite* or *Vertical Angles*, as 1. Thoſe that are made by two Right-lines croſſing each other, and which touch only in their Angular Point. Thus the Angles *a* and *b*, or *c* and *d*, are called *Oppoſite* or *Vertical Angles*, becauſe they are oppoſed *ad Verticem*, or at the Head; and therefore in ſome Books are called *Head Angles*. Theſe are always equal one to another, becauſe each, with the *Contiguous one*, makes two Right Angles.



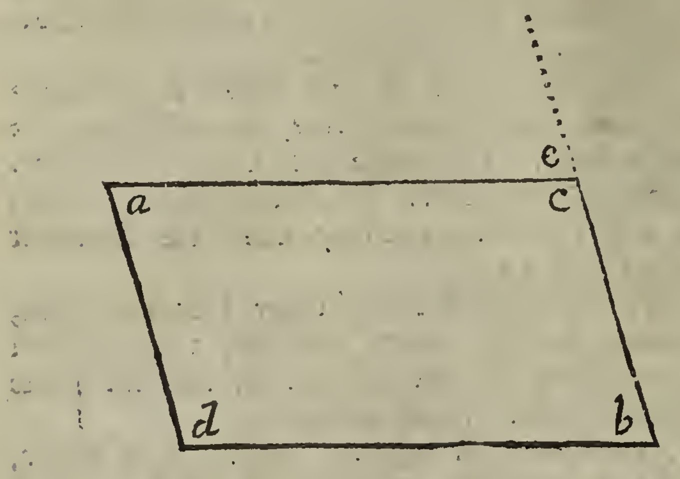
An Angle alſo in any Triangle is ſaid to be *oppoſite* to the Side that *ſubtends it*; as the Angle *a* is to the Side *B*. (*Fig. preced.*)

4. In any Triangle, as *a e f* (*ſee the ſame Figure*) the Angle *e* and *a* are called *Internal* and *Oppoſite*, in reſpect of the *External Angle f*, which is equal to them both.

5. If a Line cut two others that are parallel, the Angles *c* and *d* are called *Internal* and *Oppoſite* alſo, in reference to the *External* one *a* and *b*, to which they are ſeverally equal.



6. The Angles *a* and *b*, alſo *c* and *d*, in every Rectangle or Parallelogram, are called the *Oppoſite Angles*, and are always equal to one another; for the Angle *a* is equal to the Alternate one *e*, and *e* is equal to the Internal and Oppoſite one on the ſame Side *b*, wherefore *a* is equal to *b*; and after the ſame Manner may *d* and *c* be proved equal to each other.



ANGLE of *Right Aſcenſion*, is the Angle which the Circle of the Star's Right Aſcenſion maketh with the Meridian at the Pole of the World.

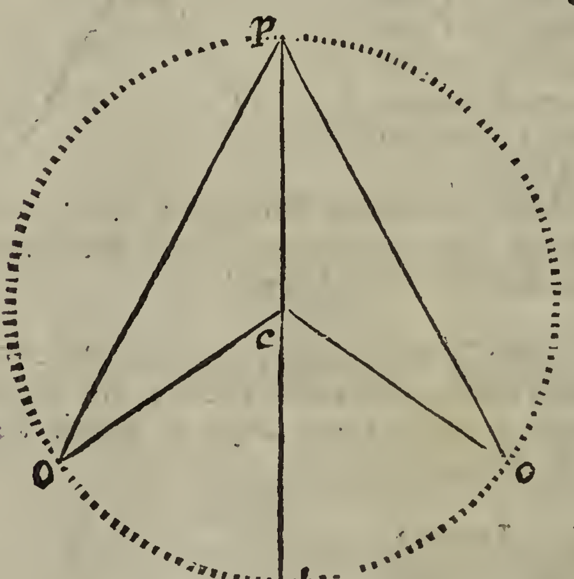
ANGLE *at the Center of a Circle*, is an Angle made there by two *Radius's* which meet in the Centre.

Propoſition.

If ſtanding or inſiſting on the ſame Chord, or being in the ſame Segment, two Angles are formed, as *o c d*, *o p d*, one at the Centre, and the other at the Circumference: The Angle at the Centre is always double of that at the Circumference. Of this there are three Varieties.

1. When one Leg of the Angle is the Diameter of the Circle, then 'tis plain the Angle at the Centre *o c d* being external to the Triangle *o c p*, will be equal to $o + p$ (by 16 *e* 1 *Eucl.*) but $o = p$, becauſe the Triangle is an *Iſoſceles* (5 *e* 1.) wherefore $c = 2p$. *Q. E. D.*

Caſe 2.

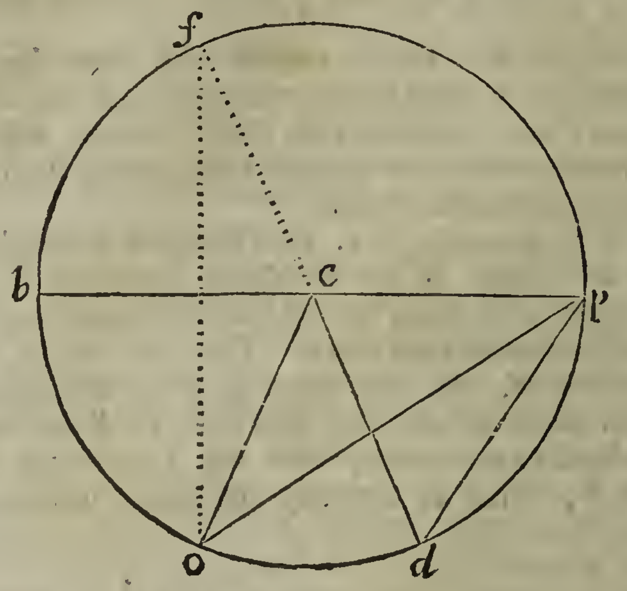


2. When the Diameter divides the two Angles, then 'tis plain, the whole Angle at the Centre *o c o* muſt be double to the whole Angle *o p o* at the Circumference, becauſe its Parts are ſeverally double of the Parts of *P* (by the *1ſt Caſe.*)

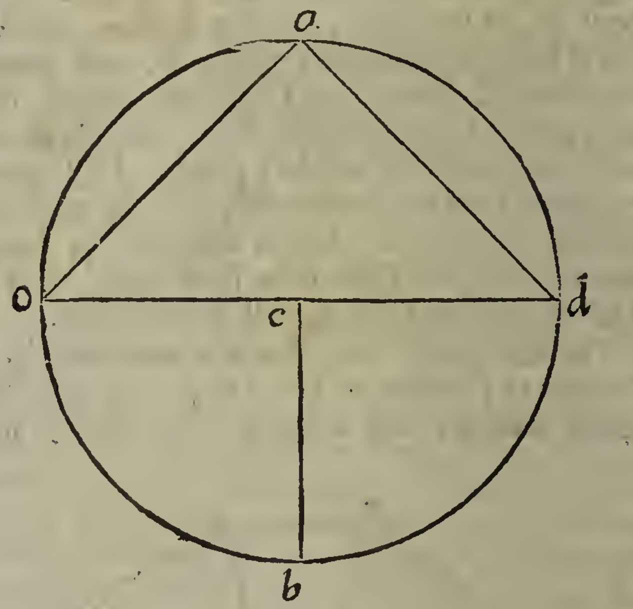
Caſe 3. When the Angles fall both on the ſame Side of the Diameter, then 'tis plain the whole external Angle *b c d* is $= 2\,c\,p\,d$, and the Part $b\,c\,o = 2\,c\,p\,o$; wherefore the remaining Part *o c d*, the Angle at the Centre, muſt be double to *c p d*, the Angle at the Circumference. *Q. E. D.*

And hence are dedudible the following *Corollaries.*

1. All Angles of *o f d* and *o p d* ſtanding on the ſame Ark, or being in the ſame Segments, are equal, becauſe they are juſt the Halves of the Angle *o c d* at the Centre.

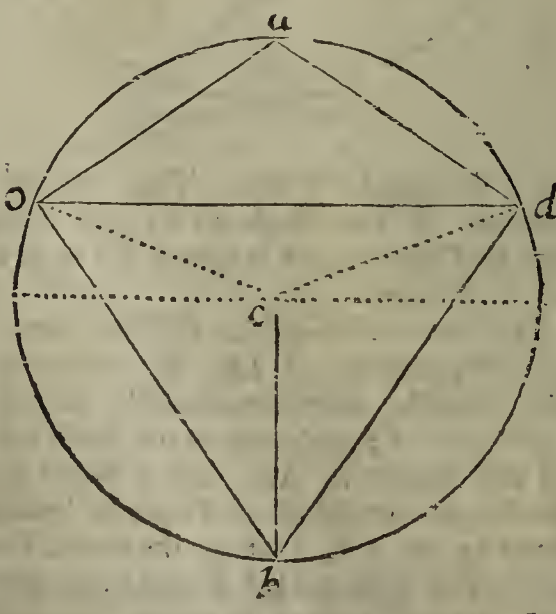


2. Hence any Angle at the Centre *c* ſtanding on half the Ark *o b* muſt be equal to one at the Circumference *a*, which ſhall ſtand on *o d* the whole Ark, on the Double of the former Ark.



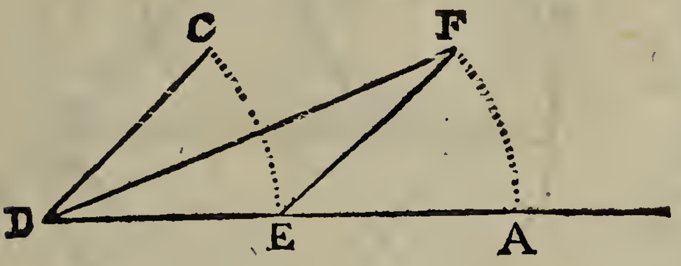
3. And from hence 'tis plain, that every Angle in a Semi-circle, as *a*, muſt be a Right one; becauſe 'tis equal to *c* at the Centre, which ſtands on a Quadrant, and is a Right Angle.

4. Wherefore an Angle, as *a*, made in a Segment leſs than a Semi-circle, muſt be *obtuſe*, becauſe 'tis equal to *o c b*, which is bigger than a Right one.



5. And conſequently the Angle b made in the Segment $o\,b\,d$, which is greater than a Semi-circle, is *acute* ; for the Angle a of the Quadrilateral Figure $o\,a\,d\,b$ inſcribed in a Circle, being *obtuſe*, b muſt needs be an *acute* one, ſince the Sum of both is but 2 ∟s, (by 22 *e.* 3. *Euclid.*

Hence may be drawn this *Problem* for the Biſſection of any Angle or Ark of a Circle ; as ſuppoſe the Angle $C\,D\,E$, or the Ark $C\,E$.



Taking $E\,A = D\,E$, on the Centre E, make the Ark $F\,A = C\,E$, and the Angle $F\,E\,A = C\,D\,E$, then draw $D\,F$, and that ſhall biſſect the Ark $C\,E$, or the Angle $C\,D\,E$: For the Angle $F\,E\,A\,(= C\,D\,E)$ is double (becauſe an Angle at the Centre) to $F\,D\,A$ an Angle at the Circumference.

ANGLE *of or at the Center*, [in *Fortification*,] is that which is made by the Concourſe of two Lines drawn from the Angles of the Figure.

ANGLE *at the Circumference of a Circle*, is an Angle made by any two Chords which meet there in a Point.

ANGLE *of the Circumference*, [in *Fortification*,] is the mix'd Angle made by the Arch which is drawn from one Gorge to another.

ANGLE *of the Counterſcarp*, is made by the two Sides of the Counterſcarp meeting before the Middle of the Curtain.

ANGLE *of the Curtain*, or *Angle of the Flank*, is that which is made by, or contained between the Curtain and the Flank in any Piece of Fortification.

ANGLE *of the Complement of the Line of Defence*, is the Angle proceeding from the Interſection of the two Complements one with another.

ANGLE *Diminiſhed*, [in *Fortification*,] is that which is made by the meeting of the outermoſt Sides of the Polygon, and the Face of the Baſtion.

ANGLE *of the Ecliptick with the Vertical Circle*, or, as ſome call it, *Parallactick Angle*, is thus found ; As the Tangent of the Sun's Diſtance from *Aries* : Is to *Rad.* : : So is the Tangent of his Declination : To the Co-ſine of the *Parallactick Angle.*

ANGLE *of Evection* : See *Evection.*

ANGLE *of the Exterior Figure*, or, *the Angle of the Polygon*, is that which is formed at the Point of the *Baſtion*, by the meeting of the two outermoſt Sides or Baſes of the Polygon.

ANGLE *of the Interior Figure*, [in *Fortification*,] is that which is made in the Centre of the Baſtion, by the meeting of the innermoſt Sides of the Figure.

ANGLE *Flanking*, is that which is made by the meeting of the two *Raſant* Lines of Defence, *viz.* the two Faces of the Baſtion prolonged.

ANGLE *flanking inward*, is the Angle made by the Flanking Line and the Curtain.

ANGLE *Flank'd*, by ſome called the *Angle of the Baſtion*, in *Fortification*, is that which is made by the two Faces, being the outmoſt Part o the Baſtion moſt expoſed to the Enemy's Batteries, and therefore by ſome is called *the Point of the Baſtion.*

ANGLE *forming the Flank*, is that which conſiſts of one Flank and one Demi-Gorge.

ANGLE *forming the Face*, [in *Fortification*,] is that which is compoſed by one Flank and one Face.

ANGLE *of Incidence* : See *Incidence.*

ANGLE *of Inclination in Opticks* : See *Inclination.*

ANGLE *of Inclination* of the *Axis* of the Earth to the *Axis* of the Eclipick, is 23°. 30, and remains inviolably the ſame in all Points of the Earth's annual Orbit.

Mr. *Keil*, in his Examination of *Burnet*'s *Theory of the Earth*, has ſhewn the great Wiſdom of God in thus placing the *Axis* of the Earth obliquely to the Plane of the Eliptick ; for by that Means all thoſe who live beyond 45° of Latitude, have more of the Sun's Heat, take all the Year round ; and thoſe who live within 45°. have leſs than if the Earth moved always in the Equinoctial, *p.* 69, *&c.* And beſides, 'tis the oblique Poſition that cauſes all our Diverſities of Seaſons, and different Degrees of Heat and Cold.

ANGLE *of Longitude*, is the Angle which the Circle of a Star's Longitude maketh with the Meridian at the Pole of the Eclipticк.

ANGLE *of the Meridian and Ecliptick* is found thus : As *Rad* : *T*, of the Sun's greateſt Declination : : So is the Co-ſine of his Longitude or Diſtance from *Aries* : To the Co-Tangent of the Angle ſought.

ANGLE *of the Meridian with the Horizon*, is thus found ; As the Co-ſine of the Sun's Declination is to *Rad* : : So is the Co-ſine of the Elevation of the Equinoctial : To the Sine of the Angle required.

ANGLE *of the Moat*, in *Fortification*, is that which is made before the *Curtain*, where it is interſected.

ANGLE *of the Parallax* : See *Parallax.*

ANGLE *of the Interval of two Places*, is the Angle made by the Lines directed from the Eye to thoſe Places.

ANGLE *of the Sun's Poſition*, is the Angle made by the Interſection of the Ark of the Meridian Line with an Ark of an Azimuth, or any other great Circle cutting thro' the Body of the Sun.

ANGLE *of Reflection* : See *Reflection.*

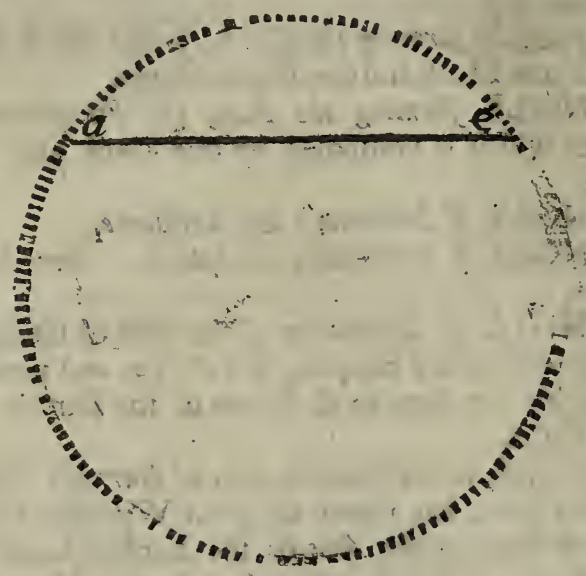
ANGLE of *Reflection* : See alſo *Incidence.*

ANGLE *of Refraction* : See *Refraction.*

ANGLE *Refracted*, in *Opticks*, is the Angle between the Refracted Ray and the Perpendicular.

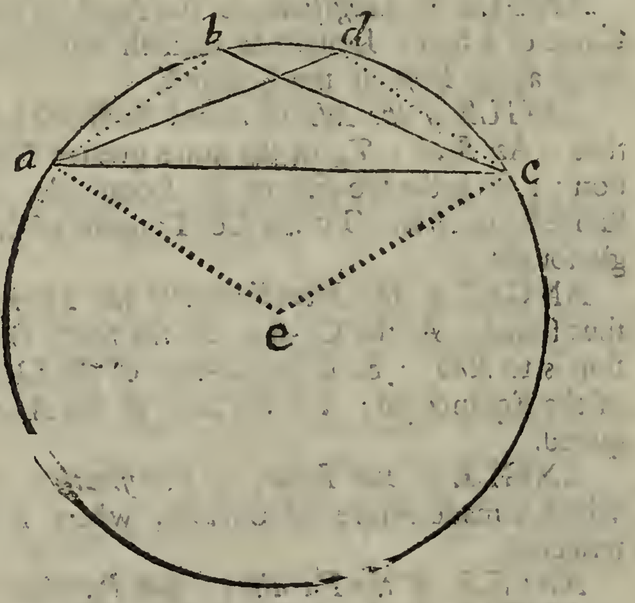
ANGLE *Re-entring*, or *Re-entrant Angle*, in *Fortification*, is that which retires inward toward the Place.

ANGLE *of a Segment*, is an Angle made by the Circumference, and a Right-line cutting it:



Thus here the two mix'd Angles *a* and *e*, made by the Chord, and the Ark, are called *Angles of a Segment.*

ANGLE *in a Segment*, is an Angle made by two Right-lines riſing from the Angles of the Segment, and meeting in the Circumference: Thus



the Angle *a b c inſiſting* or ſtanding on the Chord *a e*, and having its Vertex in the Circumference of the Circle, is called *an Angle in the Segment a b c.*

Propoſition.

All Angles in the ſame Segment, or ſtanding on the ſame or equal Arches or Chords, are equal, becauſe they are juſt the Halves of the Angles at the Centre ſtanding on the ſame Ark. See *Angles of the Centre.*

ANGLE *Sailant*, is that which advances its Point towards the *Field.* This is called *Sortant* or *Viff.*

ANGLE *of the Sun's apparent Semi-Diameter in his neareſt Diſtance to the Earth*; *Bullialdus* found it by two Obſervation to be 16 *min.* 45 *ſec.* And the Semi-Diameter of the Moon he found to be 16 *min.* 54 *ſec.* And the Semi-Diameter of the Earth's Shadow, he found in an Eclipſe of the Moon to be 44 *min.* 9 *ſec.*

ANGLE *Spherical*, is made on the Surface of the Globe or Sphere, by the Interſection of two Arks of great Circles.

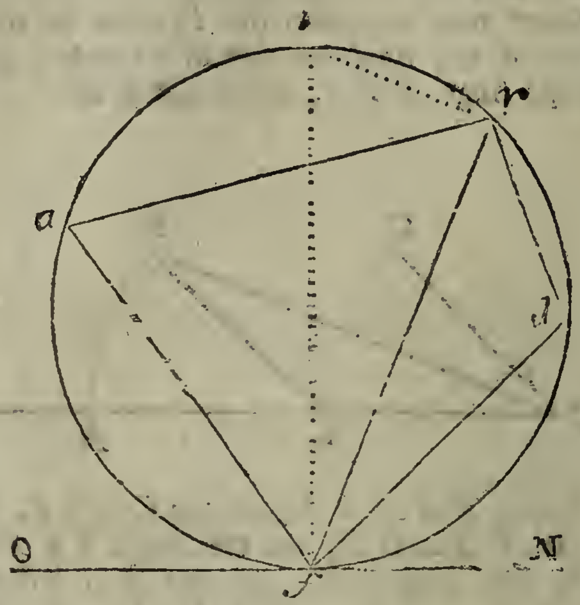
ANGLE *of the Shoulder*, [in *Fortification*,] is that which is conſtituted by the Lines of the Face and Flank.

ANGLE *Solid*: See *Solid Angle.*

ANGLE made by the Tangent to a Circle and any Chord drawn from the ſame Point of Contact, is equal to any Angle that can be made in the oppoſite Segment, 32. *e.* 3. *Euclid.*

I ſay $\llcorner\ r f n = \llcorner\ a$.

Draw the Diamerer *b f*, and alſo the Line *b r*.



Demonſtration.

Becauſe *f b* is a Diameter, the Angle *b r f* is a Right Angle; wherefore the Angles *b* and *b f r* together muſt be equal to a Right Angle.

Alſo, *b f r* and $r f n = \llcorner$, becauſe *f n* is a Tangent; therefore take away *b f r*, which is common to both, and $\lrcorner\ b = r f n$.

But the $\lrcorner\ b = \lrcorner\ a$, becauſe in the ſame Segment, wherefore $\llcorner\ a = \llcorner\ r f n$. *Q. E. D.*

Alſo, I ſay, $\lrcorner\ o f r = \lrcorner\ d$.

Demonſtration.

The $\lrcorner\ o f r + r f n = 2 \llcorner$

And $\lrcorner\ d + \lrcorner\ r f d + \lrcorner f r d = 2$ [ ]

But $\lrcorner\ r f n = r f d + f r d$.

Therefore taking away *r f n* from both, the $\lrcorner\ d$ will remain equal to the $\lrcorner\ o f r$. *Q. E. D.*

Corollary.

Hence 'tis plain, that the oppoſite Angles *d* and *a*, of any quadrilateral Figure inſcribed in a Circle, are equal to two Right Angles.

For $d + a = o f r + r f n = 2 \llcorner$s.

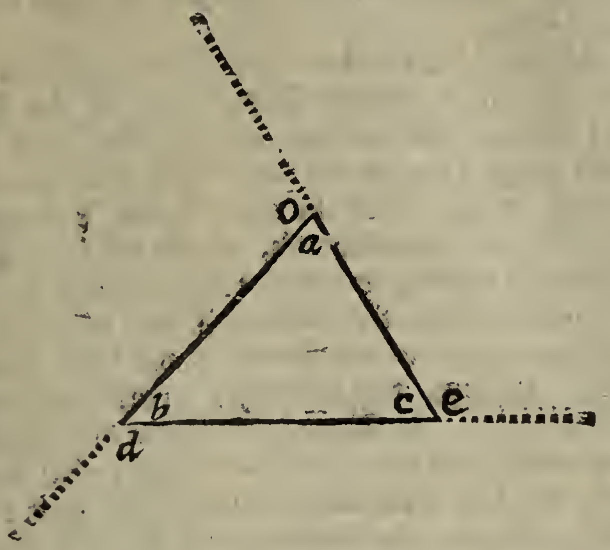
ANGLE *of the Tenaille*, or the *outward Flanking Angle*, called alſo *Angle Mort*, or the *Dead Angle*, *Angle Rentrant*, or *Angle Inwards*, is made by the two Lines *Fichant*, in the Faces of the two Baſtions extended till they meet in an Angle towards the Curtain, and is that which always carries its Point in towards the Work.

ANGLE *of the Triangle*, [in *Fortification*,] is half of the Angle of a Polygon.

ANGLES *Alternate*, are *o* and *c*, as alſo *e* and *d* in Figure, *N.* 5: and are always equal to one another.

ANGLES *of a Battalion*, are made by the laſt Men at the Ends of the Ranks and Files: And the two laſt Men of the Front and Rear Rank, are called { *Front* and / *Rear* } *Angles.*

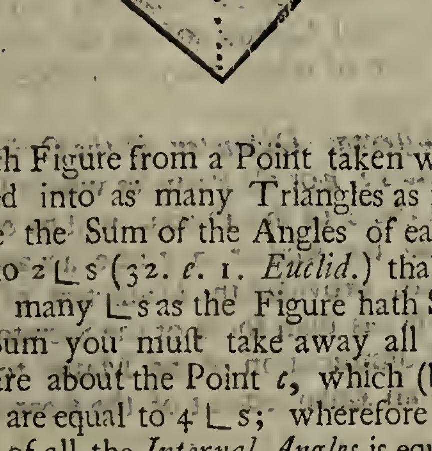
ANGLES *External*, are the Angles of any Right-lined Figure without it, when all the Sides are ſeverally produced; and they are all taken together, equal to four Right Angles: And, in particular, of a Triangle, the external Angle *e* is equal to both the internal and oppoſite ones *a* and *b*. *See the Demonſtration of which under* Triangle.



And as to the former Part; that the Sum of the external Angles of any Plane Figure is = to 4 ∟s, is plain from hence; that the Sum of all the Angles of any Right-lined Figure, both internal and external, muſt be = to twice as many ∟s as the Figure hath Sides, (by 13 *e.* 1. *Euclid.*) But the internal ones are = to twice as many ∟s as the Figure hath Sides, except four; (by *Theor.* 1. *Prop.* 32. *e.* 1. *Barrow*'s *Euclid.*) wherefore the external Angles all together muſt be equal to thoſe four Right ones.

ANGLES *Internal*, in general, are all Angles made by the Sides of any Right-lined Figure within: Alſo the two Angles between the parallel Lines on each Side the croſſing Line, as *o* and *d*, *e* and *c* (in *Fig.* 5.) are called the two *Internal Angles*, and are always equal to two Right ones. The Angle *c* and *d* (ſee *Fig.* 5.) are alſo called *Internal and oppoſite Angles* in Reſpect of *a* and *b*, as hath been lately ſaid.

The Sum of all the *Internal Angles* of any Right-lined Figure, is equal to twice as many Right Angles as the Figure hath Sides, except 4. For ſince



every ſuch Figure from a Point taken within it, can be divided into as many Triangles as it hath Sides, and ſince the Sum of the Angles of each Triangle is equal to 2 ∟s (32. *e.* 1. *Euclid.*) that will make twice as many ∟s as the Figure hath Sides; from which Sum you muſt take away all thoſe Angles which are about the Point *c*, which (by 13. *e.* 1. *Euclid*,) are equal to 4 ∟s; wherefore the remaining Sum of all the *Internal Angles* is equal to twice as many Right Angles as the Figure hath Sides, except 4. *Q. E. D.*

ANGLE *of Inclination of the Plane of a Planet's or Comet's Orbit to that of the Ecliptick*, is the Angle made by the Interſection of the Planes of thoſe two Orbits. For the Orbits of the Planets are by no Means all in the ſame Plane, but diverſly inclined to one another and to the Orbit of the Earth, which is taken for the Standard, and is call'd the Plane of the Ecliptick, in the *N.* Aſtronomy. And to this Plane the Planes of the primary Planets Orbits are thus inclined. The Angle of *Saturn*'s Orbit with the Earth's Orbit is 2°. 30'. that of *Jupiter* is 1°. 20'. that of *Mars* a little leſs than 2 Degrees; that of *Venus* a little more than 3°. 20'. and that of *Mercury* almoſt 70°. 00'.

ANGLES *Oblique*, are ſuch as are either *Obtuſe* or *Acute*, in Oppoſition to *Right Angles*.

ANGLICISM, is the *Engliſh* Idiom, or Form of Expreſſion, or Manner of Speech which is peculiar to *England*.

ANGUIFER, } [in *Aſtronomy*,] a Con-
ANGUITENENS, } ſtellation or Cluſter of Stars, the Figure of which on a Globe repreſent a Man.

ANGUINEAL *Hyperbola*, is one of an Eel-like Figure, which cuts its Aſymptote with contrary Flexions; and is produced both Ways with contrary Legs. See *Curves*.

ANGULAR, is that which relates to, or hath *Angles*.

ANGULAR *Motion*, [in *Aſtronomy*,] is the Increaſe of the Diſtance between any two Planets, &c. revolving round any Body as the Centre of their Motion, and is expreſs'd by two Right-lines drawn from the ſaid Centre to the revolving Bodies; which will open wider, and conſequently grow greater, as the revolving Bodies part farther and farther from one another.

ANHALTINA, [in *Phyſicks*,] Medicines that promote Reſpiration.

ANHELATION, a Difficulty in fetching one's Breath.

ANHELOTE, (a Term in *Law*,) ſignifying that every one ſhould pay, according to the Cuſtom of the Country, his reſpective Part and Share.

ANIENTE, (a *Law* Term) ſignifies fruſtrated or made void.

ANIMA *Hepatis*, i. e. *the Soul of the Liver*, is *Vitriolum*, or *Sal Martis*, Vitriol, or Salt of Steel, according to ſome Chymiſts.

ANIMA *Saturni*, i. e. *the Soul of* Saturn, ſignifies (with ſome Chymiſts) the Extract of Lead.

ANIMA *Pulmonum*, i. e. *the Life of the Lungs*; *Crocus* or *Saffron*, ſo called, becauſe of its being good for the Lungs.

ANIMA *Mundi*, i. e. *the Soul of the World*; which *Plato* calls Ψυχὴ τȣ̃ κόσμȣ, is by ſome defin'd to be a certain pure etherial Subſtance or Spirit; which is diffuſed through the Maſs of the World; which informs, actuates, and unites the divers Parts of it into one great perfect organical Body.

The *Anima Mundi* is, by the modern *Platoniſts*, explained to be a certain etherial, univerſal Spirit, which exiſts perfectly pure in the Heavens; but pervading elementary Bodies on Earth, and intimately mixing with all the minute Atoms of it, aſſumes ſomething of their Nature, and thence becomes of a peculiar Kind.

Others define it to be a certain ignifick Vertue, or vivifick Heat, infuſed into the *Chaos*, and diſſeminated through the whole Frame of it, for the Conſervation, Nutrition, and Vivification of it.

ANIMADVERSION, ſometimes ſignifies Correction, ſometimes Remarks or Obſervations made on a Book, &c. and ſometimes ſerious Conſiderations and Reflections on any Point. *L.*

ANIMALS, are ſuch Beings, which, beſides the Power of growing, increaſing, and producing their

Like, as Plants and Vegetables have, are endowed alſo with Senſation and ſpontaneous Motion.

For the more eaſy and clear Comprehenſion and Diſtinction of the ſeveral Kinds of *Animals*, Mr. *Ray* gives two Schemes or Tables of them: The firſt a general one of all Animals; the ſecond a particular one of *Quadrupeds.*

Animals are either

- *Sanguineous*, that is, ſuch as have Blood, which breathe either by
  - *Lungs*, having either
    - *Two Ventricles in their Heart*, and thoſe either
      - *Viviporous.*
        - *Aquatick*, as the Whale-kind.
        - *Terreſtrial*, as Quadrupeds.
      - *Oviparous*, as Birds.
    - *But one Ventricle in the Heart*, as Frogs, Tortoiſes, and Serpents.
  - *Gills*, as all Sanguineous Fiſhes, except the Whale-kind.
- *Exſanguineous*, or without Blood, which may be divided into
  - *Greater*, and thoſe either,
    - *Naked*,
      - *Terreſtrial*, as naked Snails,
      - *Aquatick*, as the Poulp, Cuttle-fiſh, *&c.*
    - *Covered with a Tegument*, either
      - *Cruſtaceous*, as Lobſters and Crab-fiſh.
      - *Teſtaceous*, either
        - *Univalve*, as Limpets,
        - *Bivalve*, as Oyſters, Muſcles, Cockles.
        - *Turbinate*, as Periwinkles, Snails, *&c.*
  - *Leſſer*, as Inſects of all Sorts.

Viviparous Hairy Animals or *Quadrupeds*, are either

- *Hoof'd*, which are either
  - *Whole-footed* or *hoof'd*, as the Horſe and Aſs.
  - *Cloven-footed*, having the Hoof divided into
    - *Two principal Parts*, called *Biſulca*, either
      - *Such as chew not the Cud*, as Swine.
      - *Ruminant, or ſuch as chew the Cud*, divided into
        - *Such as have perpetual and hollow Horns.*
          - *Beef-kind.*
          - *Sheep-kind.*
          - *Goat-kind.*
        - *Such as have ſolid, branched, and deciduous Horns*, as the *Deer-kind.*
    - *Four Parts*, or *Quadriſulca*, as the *Rhinoceros* and *Hippopotamus.*
- *Claw'd* or *Digitate*, having the Foot divided into
  - *Two Parts*, or Toes, having two Nails, as the *Camel-kind.*
  - *Many Toes* or Claws; either
    - *Undivided*, as the *Elephant.*
    - *Divided*, which have either
      - *Broad Nails*, and an *human Shape*, as *Apes.*
      - *Narrower, and more pointed Nails*, which in Reſpect of their Teeth, are divided into ſuch as have
        - *Many Fore-teeth*, or *Cutters* in each Jaw;
          - *The Greater*, which have
            - *A ſhorter Snout and rounder Head*, as the *Cat-kind.*
            - *A longer Snout and Head*, as the *Dog-kind.*
          - *The Leſſer*, the *Vermin* or *Weazel-kind.*
        - *Only two large and remarkable Fore-teeth*, all which are *Phytivorus*, and are called the *Hare-kind.*

ANIMALCULA, are very ſmall Animals, ſuch as by the Microſcope have been diſcovered in moſt Fluids, of which there are prodigious Numbers in Black Pepper Water, and as I have often ſeen alſo in Water wherein Barley, Oats, and eſpecially Wheat, hath been ſteeped for about four or five Days.

ANIMALCULA. Mr. *Lewenhoek* has been very curious in making Experiments of this Kind, and tells us, that having taken a Pike, and ſome other Male Fiſh, at the ſame time that theſe Fiſh ſpawn, he perceived in their Sperm a prodigious Quantity of little Animals, which were living, and continued moving themſelves long enough for him to obſerve them three ſeveral Times with his Microſcope, and to reſt himſelf ſome time between each. He ſays, that in every Proportion of Sperm, that was about the Bigneſs of a Grain of Sand, there was above Ten thouſand little Fiſhes; that thoſe of both the Fiſh were much a-like, and their Bodies much leſs than the Bodies of the Animals that are found in the Teſticles of Beaſts, but their Tails longer and ſmaller. He alſo made the like Experiments upon a Hare, a Dog, and a Cock, and had diſcovered an infinite Number of other living Animals in their Teſticles, which were encompaſſed with a tranſparent Matter. But the Hare being dead three or four Days, he perceived neither Life nor Motion in its little Animals, although he obſerved them to have very near the ſame Form as thoſe of the other Beaſts had.

'Tis true, this Objection hath been made againſt the Experiment, that the Motion of the Parts of the Spawn was only an Effect of Fermentation; and that it does not follow from thence, that each Part of this agitated Matter was a living Animal. To which he anſwers, That he diſtinctly perceiv'd thoſe little Creatures to be compoſed of all the requiſite Parts; and he is ſo fully perſuaded of the Exiſtence, Life, and almoſt infinite Multitude of theſe little Animals, that he maintains, in the Quantity of Sperm that one of theſe Fiſh might eject in a Year, there are more little living Fiſhes, than there are Men in the World. To prove which, he ſuppoſes an Hundred Particles of Sperm, each as big as a Grain of Sand, to make a Cubick Inch, and all this Quantity of Sperm to be multiplied by 15 Cubick Inches.

ANIMAL *Secretion*, is that Separation of Juices from one another, as is performed by the Glands; and tho' it is of the greateſt Importance to be well underſtood, of any one Branch of Phyſical Knowledge, yet it has not been talk'd of by any in an intelligible Manner, until ſome Authors, by the Aſſiſtance of Geometrical Reaſoning, have demonſtrated the Laws of Circulation in an animal Machine; the Sum of which may be conceived under theſe three Heads.

1. *The different Diameter of the Orifice of the Secretory Ducts:* For all Particles whoſe Diameters are leſs than thoſe of the Ducts, will be excluded; inſomuch that any Matter may be evacuated by any of the Glands, provided the Diameters of its Particles be made leſs than thoſe of the Secretory Duct, either by a Comminution of the Matter to be ſeparated, or by an Enlargement of the ſeparating Paſſage.

2. *The different Angle which the Secretory Duct makes with the Trunk of the Artery:* For all Fluids preſs the Sides of the containing Veſſels in a Direction perpendicular to its Sides; which is evident in the Pulſation of the Arteries, ſince it is to that Preſſure that the Pulſation is owing. It is likewiſe evident, that the Blood is urged forward by the Force of the Heart; ſo that the Motion of Secre-

tion is compounded of both theſe Motions. Now the lateral Preſſure is greater, when the direct Velocity is ſo too; but yet not in Proportion to ſuch Velocity; For the lateral Preſſure is conſiderable, even when the Fluid is at Reſt, being then in Proportion to the ſpecifick Gravity of the Fluid; and in a Fluid like the Blood in the Arteries, which is thrown in a right Direction, or in a Direction parallel to the Axis of the Veſſel, the lateral Preſſure will be in a compound Proportion to both: from whence it will follow, that if two Particles be of equal Diameters, but unequal ſpecifick Gravities, do arrive with the ſame Velocity at an Orifice capable of admitting them, yet they will not both enter it and paſs, becauſe their Motion of Direction will be different; ſo that the Diverſity of the Angles which the Ducts make with the Trunk of the Artery, is altogether neceſſary to account for all the poſſible Diverſities of ſecerned Fluids, even ſuppoſing their Diameters and Figures to be the ſame.

3. *The different Velocities with which the Blood arrives at the Orifices of the ſecretory Ducts.* For ſince the Secretions are made in Form of a Fluid, no poſſible Reaſon can be aſſigned, why Animals have a ſoft looſe Texture and Union of ſolid Parts; and why one Part of the Body is of an eaſily ſeparated Texture, and another of a firmer, but this different Velocity of the Blood at the Orifices of the ſecretory Duct, whereby the ſecerned Particles for Nouriſhment and Accretion are drove or impacted into the *Vacuola* that receive them with a greater or leſſer Force; for it is difficult to imagine, that ſuch a Diverſity in Texture can altogether proceed from the different Solidities and Contacts of the conſtituent Parts.'

Dr. *Wainwright* has prefixed ſome Propoſitions upon this Head, interſperſed with ſome properly Hydroſtatical, to his Book of *Non-naturals*, which may be worth Recital here.

Prop. 1. A Fluid muſt have its compounding Parts ſmall, ſpherical, or approaching thereunto; ſmooth, or ſuch as can eaſily ſlide over one another, and if homogenous, the Parts muſt be of equal Denſity.

Prop. 2. Fluids preſs *undequaque*; and the Direction of their Preſſure is in every Point perpendicular to the Sides of the containing Veſſel; and therefore Secretion is performed by a Compoſition of two Motions, direct and tranſverſe.

Prop. 3. Of an heterogeneous Fluid at Reſt in the Body, and equally preſſed, the moſt ſolid Part is forced out firſt.

Prop. 4. An heterogenous Fluid, ſuch as the Blood, whoſe compounding Parts are of different Denſities, upon its Stagnation will precipitate its heavy, and elevate its light Parts, and they in all Time will take their Places according to their ſpecifick Gravities; and where the Fluid does not ſtagnate, the Separation of the heavy Parts from the light, will be in Proportion to the Slowneſs of the Motion of the Mind.

Prop. 5. The red fibrous Part of the Blood, upon its Stagnation, retires into the Centre, and forces the *Serum* to the Outſide of the Veſſel.

Corol. The ſlower the Blood's Motion is, the more *Serum* is ſeparated.

Prop. 6. Fluids reſiſt the Motion of ſuch Bodies moſt, whoſe Surfaces are greateſt, in Proportion to their Solidities; or, in other Words, whoſe ſpecifick Gravities are leaſt.

Prop. 7. The moſt viſcid Parts of *Serum* are lighteſt, *viz.* ſuch as are ſeparated in the Glands of the Noſe, Mouth, Palate, Wind-pipe, Stomach, Guts, *&c.* becauſe theſe ſwim in Water, which is lighter than *Serum*.

Corol. to the two laſt Propoſitions. The moſt viſcid Part of the *Serum* of the Blood is the leaſt ſuſceptible of Motion, or it is moved with the greateſt Difficulty through the Arteries.

Prop. 8. A Fluid forc'd through a concave Cylinder, moves with a greater Celerity at the Axis, than at the Sides; and much more ſo through a concave Cone.

Prop. 9. The moſt light Parts being the leaſt ſuſceptible of Motion, will be forced to the Sides of the Arteries where there is the leaſt Motion; ſo that where there is the leaſt Motion, there the lighteſt Part of the Serum will be ſeparated (by the 7th Propoſition) that being the moſt viſcid.

Corol. 1. The Viſcidity of the ſeparated Fluid will be reciprocally as the Celerity of the Blood at the Orifice of the ſeparating Canal.

Corol. 2. The Velocity of the Blood at the Orifice of the ſeparating Canal, being the Number of Plications in the complicated Artery, the Viſcidity of the ſecerned Matter will be as the Number of Plications in the complicated Artery.

Prop. 10. When the Motion of the Blood is too ſlow, the moſt ſerous Part of the Blood is thrown upon theſe Arteries, which are the ſmalleſt, moſt complicated, or at the greateſt Diſtance from the Heart: For the Motion of the Blood being too ſlow, more of the red Part of it will move along the Axis of the Artery than before, (by Propoſition 5.) therefore the red Part will move with much greater Celerity than the *Serum*, (by the 8th and 9th Propoſitions;) and conſequently through ſuch Arteries where there is the leaſt Reſiſtance; that is, through the wideſt, the leaſt complicated, and thoſe neareſt the Heart; for which Reaſon, the *Serum* will be forced upon ſuch Arteries as are the ſmalleſt, moſt complicated, or at the greateſt Diſtances from the Heart.

Prop. 11. A Gland is a complicated Artery, which ſends excretory Veſſels out of its Sides; after which it degenerates into a Vein.

Prop. 12. The Inteſtines are a Gland, and the Lacteals are the ſecretory Veſſels.

Prop. 13. The Orifices of the excretory Veſſels of every Gland are circular, ſince all the Veſſels in which the Fluids of the Body move, are either concave Cylinders or Cones; for the Preſſure of a Fluid being always perpendicular to the Sides of the containing Veſſel, and being at equal Diſtances from the Centre, the Sides muſt be every where equally diſtracted, *viz.* a Secretion perpendicular to the Axis of the Veſſel muſt be a Circle; and conſequently, the Veſſel be either cylindrical or conical. This is fully demonſtrated by Dr. *Pitcairne*.

Corol. 1. The Orifices of the excretory Veſſels of different Glands differing only in their Magnitude, the Fluids ſeparated in differing Glands, will differ only in Degrees of Coheſion and Fluidity.

Corol. 2. Any peccant Matter in the Blood, may be evacuated by any of the Glands, provided their Orifice be but ſufficiently enlarged.

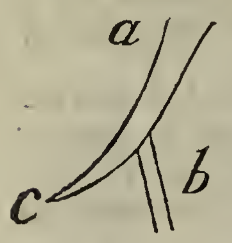
Corol. 3. The increaſing of one Evacuation will leſſen another, and *vice verſa*.

Prop. 14. All the conglomerate Glands have Coats made of Muſcles, Fibres, with which they force out their Contents by Contraction, and the more in Quantity, or the more forcible any ſecerned Matter is to be expelled, the ſtronger are the muſcular Fibres.

Prop. 15. The relaxed Coat of any Gland increaſes the Viſcidity of the ſecerned Matter, and *vice verſa*; for the ſecerned Matter will grow more viſcid by ſtaying longer in the Gland, and the thin Part being evaporated by the Heat of the Body, the reſt will be more viſcid.

Corol. Opiates, Drunkenneſs, and whatſoever makes an univerſal Relaxation, increaſe the Viſcidity of the Matter ſeparated in all the conglomerated Glands.

Prop. 16. Such Glands whoſe compounding Arteries are moſt complicated, ſecern the moſt viſcid Matter from the Blood.



Demonſtration. Let there be a branched Canal of the annexed Figure, and let the Extremity of one of the Branches *c* be ſhut up, and the other Branch *b* be open; then by an Engine force through the Trunk *a* any Kind of viſcid Liquor, ſuch as the Blood; or whoſe compounding Parts are ſome more and ſome leſs fluxile, and it equally run into both the Branches till the Branch *c* be full; but after that, what ſhould move through *c*, muſt paſs through *b*; ſo that the whole Liquor that paſſes through the Trunk *a*, muſt likewiſe in the ſame Time paſs through the Branch *b*; now *b* being much ſtraiter than *a*, the Liquor muſt paſs with greater Celerity through *b* than *a*, ſo that as ſuch Parts of the Liquor as are moſt eaſily moved, will firſt paſs the Branch *b*; and the Parts that are leaſt ſuſceptible of Motion, or, in other Words, thoſe which are moſt viſcid, will be ſolliciting their Entrance into the Branch *c*; but this viſcid Matter cannot enter without forcing ſome of the moſt moveable or fluid Part of what is contained in *c* into *b*; ſo that *c* will conſtantly fill with viſcid Matter till it can hold no more: If therefore the Extremity of the Branch of any Artery be totally obſtructed, it is hereby diſpoſed to fill with the moſt viſcid Matter the Blood can ſupply, and that for this Reaſon, *viz.* Becauſe the progreſſive Motion of the Blood thro' that Branch muſt ceaſe; and in ſuch Branches of any Artery where the Motion of the Blood is the moſt retarded, through that Branch will the moſt viſcid Part of the Blood paſs, as the moſt fluid will in thoſe Branches where there is the leaſt Reſiſtance to the Motion of the Blood. Now in every complicated Artery, the Reſiſtance being greater than in a ſtrait one, the Motion of the Blood will be ſlower, and that in Proportion to the Number of Plications in the complicated Artery; therefore in the Arteries which are moſt complicated, the Motion of the Blood in them being the ſloweſt, its Viſcidity will be the greateſt; and therefore ſuch Glands whoſe compounding Arteries are moſt complicated, ſecern the moſt viſcid Matter from the Blood. *Q. E. D.*

Prop. 17. The Quantity of fluid Matter ſeparated in any Gland, is in compound Proportion of the Quantity of Blood, its Celerity at the Orifices of the excretory Veſſels, the Wideneſs of the Orifices of the Veſſels directly, and the Viſcidity of the Blood reciprocally.

Demonſtration. The Celerity of the Blood's Motion, the Wideneſs of the Orifices, and the Viſcidity of the Blood, being given, the Quantity ſeparated muſt be as the Quantity of Blood directly; for a greater Quantity ſeparates more, and a leſs Quantity ſeparates leſs. The Quantity of Blood, its Viſcidity, and the Wideneſs of the Orifices, being given, the Quantity ſeparated will be directly as the Celerity; for a greater Celerity gives a greater Quantity, and a leſs Celerity a leſs. The Quantity of Blood, its Celerity and Viſcidity being given, the Quantity ſeparated will be directly as the Wideneſs of the Orifices; for the wider the Orifices, the more will be ſeparated, and the ſtraiter the leſs. The Quanrity and Celerity of the Blood, and the Wideneſs of the Orifices being given, the Quantity ſeparated will be as the Quantity of Blood. *Q. E. D.*

Prop. 18. An increaſed Quantity of Blood increaſes the fluid Secretions in a Proportion greater than the viſcid.

Demonſtration. The Quantity of Blood being increaſed, the Diameter of all the Veſſels will be enlarged, but in different Proportions; for the ſame Force in an increaſed Quantity of Blood applied to the leſs complicated Arteries, will diſtend them, or enlarge their Diameters more than it will the more complicate, becauſe the Reſiſtance in theſe is greater than in thoſe, and that in Proportion to the Number of Plications, one Artery has more than another. Now the Quantity of ſeparated Matter being *cæteris paribus* as the Wideneſs of the ſeparating Canal (by the laſt Propoſition) the Quantity ſeparated in the leſs complicated Artery, whoſe Diameter is more enlarged in this Caſe, will be greater than what is ſeparated in a more complicated Artery; and ſeeing ſuch Glands whoſe compounded Arteries are moſt complicated, ſecern the moſt viſcid Matter from the Blood, and the leaſt complicated the moſt fluid (by the 16th Propoſition); therefore an increaſed Quantity of Blood, by increaſing the Diameter of the leſs complicated Arteries more than of the more complicated, increaſes the fluid Secretions more than the viſcid. *Q. E. D.*

Prop. 19. A decreaſed Quantity of Blood leſſens the fluid Secretions more than the viſcid. This needs no Proof, being the Reverſe of the laſt.

Prop. 20. An increaſed Celerity of the Blood's Motion, increaſes the fluid Secretions more than the viſcid; and, *vice verſa*, a decreaſed Celerity leſſens the fluid Secretions more than the viſcid.

Demonſtration. The Celerity of the Blood's Motion being greater, the Impetus by which the Arteries are diſtracted, or their Diameters enlarged, will be greater, and ſo exert its Force more upon the leſs complicated Arteries than upon ſuch as are more complicated, and conſequently promote the fluid more than the viſcid Secretions; and becauſe an increaſed Celerity will, by breaking the Blood into ſmall Parts, render it more fluxile, and thereby ſupply a greater Quantity of ſuch Particles as will paſs the Glands, whoſe Diameters are the leaſt; therefore upon this Account alſo, an increaſed Celerity of the Blood's Motion will increaſe the fluid Secretions more than the viſcid. *Q. E. D.*

Prop. 21. An univerſal Enlargement of the Orifices of all the Glands, increaſes the fluid Secretions more than the viſcid; and, *vice verſa*, an univerſal Contraction leſſens the fluid Secretions more than the viſcid.

Demonſtration. The Diameters of the ſmalleſt Orifices being enlarged, are big enough to ſecern the viſcid as well as the fluid Matter; and becauſe the Matter ſecerned in different Glands differ only in Degree of Coheſion and Fluidity (by the firſt

Corol. of the thirteenth Propoſition) therefore the Orifices of the ſmall Glands being enlarged, more viſcid Matter than uſed to be ſeparated in other Glands, will be ſeparated in theſe; and therefore leſs will be ſeparated in thoſe Glands that are fitted for viſcid Secretions, and more in thoſe fitted for the fluid. Therefore an univerſal Enlargement of the Orifices of all the Glands, increaſes the fluid Secretions more than the viſcid. *Q. E. D.*

Prop. 22. An increaſed Viſcidity of the Blood decreaſeth the fluid Secretions more than the viſcid; and, *vice verſa*, an increaſed Fluidity increaſeth the fluid Secretions more than the viſcid.

Demonſtration. A decreaſed Celerity of the Blood's Motion leſſens the fluid Secretions more than the viſcid, (by the 20th Propoſition;) but the Celerity decreaſeth as the Reſiſtance increaſeth; now the Reſiſtance is greateſt when the Blood is moſt fluid, becauſe it paſſeth with greateſt Difficulty through the capillary Arteries; therefore an increaſed Viſcidity, by leſſening the Celerity, decreaſeth the fluid Secretions more than the viſcid. *Q. E. D.*

ANIMATED, [*animatus*, *L.*] endued or inſpired with a Life, Spirit, Soul, *&c.*

ANIMATED *Mercury*; ſo Mr. *Boyle* calls a Mercury, which by being impregnated with ſome ſubtile, agile, and ſpirituous Particles, is render'd capable of growing hot when mingled with Gold; and ſuch alſo he calls *Incaleſcent Mercuries.*

ANIMATED *Needle*, is one touch'd with a Load-ſtone.

ANIMATED *Power*, [in *Mechanicks*,] a Power in Man or other Animal, in Contradiſtinction to an inanimate one, as that of Springs, Weights, *&c.*

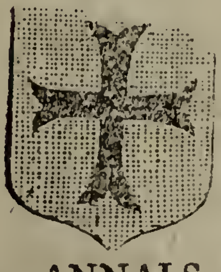
ANIMATION, is informing an animal Body with a Soul; thus the *Fœtus* in the Womb is ſaid to come to its *Animation*, when it begins to act like a true Animal, or after the Female that bears it is *Quick*, as the common Way of Expreſſion is.

ANIME', [in *Heraldry*,] is when the Eyes, *&c.* of any rapacious Creature are borne of a different Tincture from the Creature it ſelf.

ANIMODAR, [*Aſtrology*,] one of the Methods ſome uſe of rectifying a Nativity, ſo as to find out artificially the exact Minute aſcending at a Perſon's Birth.

AN-JOUR and WASTE, is a Forfeiture when a Man has committed Petit Treaſon or Felony, and has Lands held of ſome common Perſon, which ſhall be ſeized for the King, and remain in his Hands a Year and a Day next after the Attainder; and then the Trees ſhall be pulled up, the Houſes razed and pulled down, and the Paſtorage and Meadows plowed up, unleſs he to whom the Lands ſhould come by Eſcheat or Forfeiture redeem it of the King.

ANI SCALPTORIS MUSCULI PAR, is the Muſcle called alſo *Latiſſimus Dorſi*, from its Largeneſs; its Uſe is to draw the Arm backward and downward; and therefore is called *Ani Scalptor*, becauſe it helps to ſcratch the Breech.



ANKRED, ſo the Heralds call one of their Croſſes in a Coat of Arms, whoſe Figure is this.

ANNALS, are a Chronological Account of the remarkable Events of a State, yearly, as the Annals of *Tacitus*: They differ from *Hiſtory*, becauſe this diſcants upon thoſe Events, and on the Cauſes that produced them. The Writer of ſuch an Hiſtory is called an *Annaliſt.*

ANNATES, (a *Law Term*,) ſignifying the ſame with *Firſt-Fruits*: The Reaſon of the Name is, becauſe the Rate of *Firſt Fruits* paid to Spiritual Livings is after the Value of one Year's Profit.

ANNEXATION, [in *Law*,] the uniting of Lands or Rents to the Crown.

ANNIENTED, (a Term in *Law*,) ſignifying as much as fruſtrated, or brought to nought.

ANNIHILATION, is the deſtroying utterly, or turning of any created Being into Nothing.

ANNOISANCE, [in *Law*,] a Nuſance, a Hurt or Offence, either to a publick Place, as a Highway, Bridge, or common River; or to a private one, by laying any thing that may breed Infection. Alſo the Name of a Writ brought for this Tranſgreſſion.

ANNUAL *Leaves*, [in *Botany*,] ſuch as put forth in the Spring of the Year, *&c.* but periſh in the Winter.

ANNUA *Penſione*, is a Writ whereby the King having due to him an Annual Penſion from an Abbot or Prior, for any of his Chaplains, (whom he ſhould think for to nominate, being as yet unprovided of ſufficient Liberty) did demand the ſame of the Abbot or Prior; and alſo willed him, for his Chaplain's better Aſſurance, to give him his Letters Patent for the ſame.

ANNUAL *Equation*, or mean Motion of the Luminaries: See *Equation.*

ANNUATES *Muſculi*, a Pair of Muſcles at the Root of the tranſverſe *Vertebra* of the Back, deſcribed by Mr. *Cowper*, and called by him *Recti Interni Minores*, becauſe they lie under the *Recti Majores*; and he thinks they may very properly have this Name of *Annuates*, becauſe they ſerve to nod the Head directly forward.

ANNUITY. Dr. *Halley*, on the *Breſlaw* Bills of Mortality, ſhews, that it is 80 to 1, that a Perſon of Five Years of Age does not die in a Year; that it is five and one half to one, that a Man of Forty Years lives Seven Years; and that one of Thirty may reaſonably expect to live Twenty ſeven or Twenty eight Years. So great a Difference there is between the Life of Man of different Ages, that it is an Hundred to One, if one of Twenty lives out a Year; and but Thirty eight to One, that one of Fifty does ſo.

Whence, and from ſome other Obſervations, he has conſtructed the following Table, ſhewing the Value of Annuities from every Fifth Year of Life to the Seventieth.

Age.	*Years.*	*Purchaſe.*
1	10	28
5	13	40
10	13	44
15	13	33
20	12	78
25	12	27
30	11	27
35	11	12
40	10	57
45	9	91
50	9	21
55	8	51
60	7	60
65	6	54
70	5	32

ANNUITY, is a yearly Rent to be paid for Term of Life, or Years, or in Fee: In *Common Law*, the Difference between a Rent and an Annuity is this; that Rent is payable out of Land.

Annuity charges only the Perſon of the Grantor. For the Valuation of *Annuities*: See *Intereſt*.

An *Annuity* cannot be taken for *Aſſets*, becauſe 'tis no Freehold in Law; nor can it be put in Execution on a Statute Merchant, Statute Staple, or Elegit, as a Rent may.

ANNUITIES, or *Penſions*, &c. are ſaid to be in Arrears, when they are payable or due, either Yearly or Half-yearly, &c. and are unpaid for any Number of Payments: Therefore the Buſineſs is to compute what all thoſe Payments will amount unto, allowing any Rate of Simple Intereſt for their Forbearance, from the Time each particular Payment became due. Now, in Order to that,

Put
$u =$ the Annuity, Penſion, or yearly Rent, &c.
$t =$ the Time of its Continuance (or being) unpaid.
$r =$ the *Ratio*, or Intereſt of 1 *l.* for one Year, as before.
$a =$ the Amount of the Annuity and its Intereſt.

Then, If $u =$ the firſt Year's Rent, due without Intereſt.

$ru =$ the Intereſt } due at the End of the ſe-
And $2u =$ the Rent } cond Year.
$ru + 2ru =$ the Intereſt } due at the End of
$3u =$ the Rent } the third Year.
$ru + 2ru + 3ru =$ the Intereſt } due at the
$5u =$ the Rent } End of the fourth Year.

And ſo on for any Number of Years.

Hence 'tis evident,

That $ru + 2ru + 3ru + 4ru +$ &c. continued to $t-1$ Terms $+ ta$ is $= u$; that is,

$$\overline{t-1}\times ru+\frac{\overline{t-1}\,|\,2\times ru-\overline{t-1}\times ru}{2}$$

$$\left(=\frac{ttru-tru}{2}\right)+tu=a.$$ Hence,

Theorem 1. $$\frac{tt-t}{2}ru+tu=a.$$

Theor. 2. $$\frac{2a}{ttr-tr+2t}=u.$$

Theor. 3. $$\frac{2a-2tu}{ttu-tu}=r.$$

Theor. 4. $$\sqrt{:\frac{2a}{ru}+\frac{xx}{4}:}-\tfrac{1}{2}x.$$

$= t$, putting $\frac{2}{r} - 1 = x$.

Queſt. 1. If 250 *l.* yearly Rent (or Penſion, &c.) be forborn or unpaid Seven Years; what will it amount to in that Time, at 6 *per Cent.* for each Payment as it becomes due?

Here is given $u = 250$, $t = 7$, and $r = .06$. To find a, *per Theor.* 1.

Firſt, $250 \times 7 = 1750 = ut$; and $1750 \times 7 = 12250 = utt$.

Again, $12250 - 1750 = 10500 = ttu - tu$:

And $\frac{10500}{2} + .06 = 315 = \frac{ttur - tur}{2}$.

Laſtly, $315 + 1750 = 2065 = a$; *viz.* 2065 *l.* is the Anſwer required.

But if the Annuity, Rent, or Penſion, is to be paid by Quarterly or Half Yearly Payments, &c. then $\frac{.06}{2} = .03 = r$ for Half Yearly Payments: And $\frac{.06}{4} = .015 = r$ for Quarterly; or, $0.035 = r$ for Three Quarterly Payments.

Example of Half Yearly Payments.

Suppoſe 250 *l.* *per Annum* to be paid by Half Yearly Payments, were in Arrears or unpaid for Seven Years; what would it amount to, allowing 6 *per Cent. per Annum* for each Payment as it became due?

In this Example, there is given $u = 125 = \frac{250}{2}$, $t = 14$ the Number of Payments, and $r = .03 = \frac{0.06}{2}$. Thence to find a.

Firſt, $125 \times 14 = 1750 = ut$. $1750 \times 14 = 24500 = utt$.

Again, $24500 - 1750 = 22750 = ttu - tu$.

Then $\frac{22750}{2} \times .03 = 341.25 = \frac{ttu \quad tu}{2} r$.

Laſtly, $341.25 + 1750 = 2091.25 = a$; that is, 2091 *l.* 5 *s.* is the Anſwer required.

N. B. *Hence it may be obſerved, that Half Yearly Payments are more advantageous than Yearly.*

For, 2091 *l.* 5 *s.* [¯ 2065 *l.* by 26 *l.* 5 *s.* Conſequently, Quarterly Payments are more advantageous than Half Yearly Payments.

Queſt. 2. What yearly Rent, Penſion, &c. being forborn or unpaid Seven Years, will raiſe a Stock of 2065 *l.* allowing 6 *per Cent. per Annum* for each Payment as it becomes due?

Here is given $a = 2065$, $t = 7$, and $r = .06$ to find u, *per Theor.* u.

Firſt, $7 \times .06 = .42 = tr$: And, $42 \times 7 = 2.94 = ttr$.

Then $ttr - tr = 2.52$: And $ttr - tr + 2t = 16.52$.

Laſtly, $16.52)\,4130\,(250 = 2a \div : ttr - tr + 2t : = u$.

That is, 250 *l. per Annum*, &c. will raiſe 2065 *l.* Stock.

Queſt. 3. In what Time will 250 *l.* yearly Rent raiſe a Stock of 2065 *l.* allowing 6 *per Cent.* &c. for the Forbearance of the Payments as they become due?

Here is given $u = 250$, $a = 2065$, and $r = .06$. To find t, *per Theor.* 4.

Firſt, $\frac{2}{r} = \frac{2}{.06} = 33.3333$. And $33.3333 - 1 = 32.3333 = x$. Then $16.16666 = \frac{1}{2}x$: And 261.3605, &c. $= \frac{1}{4}xx$.

Again, $\frac{4130}{15} = 275.3333 = 2a \div ru$. And $275.3333 + 261.3605 = 536.6938 = \frac{2a}{ru} + \frac{xx}{4}$. Then $\sqrt{536.6938} = 23.16666$.

Laſtly, $23.\,16666 - 16.\,16666 = 7 = \sqrt{} : \frac{2a}{ru} + \frac{xx}{4} : - \frac{x}{2} = t$: *viz.* Seven Years is the Time required.

Queſt. 4. If 250 *l.* yearly Rent being forborn ſeven Years will amount to 2065 *l.* allowing ſimple Intereſt for every Payment as it becomes due, what muſt the Rate of Intereſt be *per Cent.* &c.

Here are given $u = 250$, $a = 2065$, and $t = 7$. To find r, *per Theor.* 3.

$$\text{Thus, } \begin{cases} t\,t\,u = 12250 \\ -t\,u - 1750 \end{cases} - \quad \begin{aligned} 4130 &= 2a. \\ 3500 &= -2tu \end{aligned}$$

$$t\,t\,u - t\,u = 10500) \qquad 630 = 2a - 2tu\ (0.06 = r,$$

Then 1 .. 0. 06 :: 100 .. 6 the Rate required.

The Buſineſs of purchaſing Annuities, or taking of Leaſes, &c. for any aſſigned Time, depends upon the true equating of the Principal, or Money laid out on the Purchaſe, with the Annuity or yearly Rent, by allowing (or diſcompting) the ſame Rate of Intereſt to both; which may be eaſily performed by duly applying the reſpective *Theorems* together, as will fully appear by the following Queſtion.

Queſt. What is 75 *l.* yearly Rent, to continue nine Years, worth in ready Money at 6 *per Cent. per Annum* Simple Intereſt?

1. *Per Theorem* 1. as before ſet down, find what the propoſed yearly Rent would amount to if it were forborn nine Years at 6 *per Cent.*

Thus $u = 75$, $t = 9$, and $r = .06$. Quære a

$$t\,t\,u = 6075 \qquad \text{Then } 2)\ 5400\ \left(\begin{matrix} 2700 \\ .06 \end{matrix}\right\} \text{Multiply}$$

$$t\,u = 675$$

$$t\,t\,u - t\,u = 5400 \qquad 162 = : t\,t\,u\,r - t\,u\,r : \div 2$$

$$+ 675 = t\,u$$

$$837 = a$$

2. Then by *Theorem* 2. Find what Principal being put to Intereſt for the ſame Time, and at the ſame Rate, will amount to 837 $l = a$.

Thus $t\,r = 9 \times .06 = .54$ ∵ $t\,r + 1 = 1.54$

And 1. 54) 837 (543. 5064 $= p$.

That is, $p = 543$ *l.* 10 *s.* $1\frac{1}{2}$ *d.* which is the Worth of 75 *l.* a Year, as was required.

From theſe two Operations (duly conſidered) it muſt needs be eaſy to conceive, how the two *Theorems* by which they were performed, may be combined into one.

For 1. $\frac{t\,t\,r\,u - t\,r\,u}{2} + t\,u = a$. And 2. $p\,t\,r + p = a$

Conſequently, $p\,t\,r + p = \frac{t\,t\,r\,u - t\,r\,u + 2\,t\,u.}{2}$

And from this Equation may be deduced the following Theorems.

Theorem 1. $\left\{ \frac{t\,t\,r - t\,r + 2\,t}{2\,t\,r + 2} \right. u = p$. By this Theorem all Queſtions of the ſame Kind with the laſt, (*viz.* that above) may be eaſily and readily anſwered at one Operation.

Theor. 2. $\left\{ \frac{t\,r + 1}{t\,t\,r - t\,r + 2\,t} \right. \times 2\,p = u.$

Theor. 3. $\left\{ \frac{2\,p - 2\,t\,u}{t\,t\,u - t\,u - 2\,p\,t} \right. = r$

Let $\frac{2}{r} - \frac{2p}{u} - 1 = \mp x$; then will $t\,t = x\,t$ $= \frac{2p}{ru}$ which gives the following *Theorem*, viz.

Theor. 4. $\left\{ \sqrt{} : \frac{2p}{ru} + \frac{xx}{4} : \mp \frac{x}{2} = t. \right.$

By the ſecond and fourth *Theorems* two uſeful Queſtions may be eaſily anſwered.

1. As for Inſtance, If it be required to find what Annuity, or yearly Rent, &c. may be purchaſed for any propoſed Sum, to continue any aſſigned Time, allowing any Rate of Intereſt.

This Queſtion may be anſwered by *Theorem* 2.

2. Again, If it be required to find how long any yearly Rent, Penſion, or Annuity, &c. may be purchaſed (or enjoyed) for any propoſed Sum, at any given Rate of Intereſt.

All Queſtions of this Kind are eaſily anſwered by *Theorem* 4.

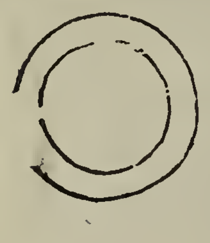
In theſe Queſtions it is ſuppoſed, that the Purchaſe or yearly Rent is to commence, or be immediately entred upon. But if it be required to find the Value or Purchaſe of any Annuity, or yearly Rent, &c. in Reverſion; that is, when it is not to be entered upon until after ſome time, or Number of Years are paſt; then firſt find what the Sum propoſed to be laid out in the Purchaſe would amount to, if it were put to Intereſt during the Time the Annuity, &c. is not to be in preſent Poſſeſſion; and make that Amount the Sum for the Purchaſe, proceeding with it as in either of the two laſt Queſtions.

ANNULAR *Cartilage*, the ſecond Griſtle of the *Larynx*, which is encompaſſed by it, as it were with a Ring.

ANNULAR *Ligament*, [*Anatomy*,] a ſtrong Ligament encompaſſing the *Carpus*, after the Manner of a Bracelet.

ANNULARIS *Proceſſus*, is a Protuberance made by the meeting of the Proceſſes of the *Medulla oblongata* under the Side thereof.

ANNULAR *Protuberance*, is, with the *Anatomiſts*, a certain Part of an human Brain, lying between the *Cerebellum* and the two backward Prominences. The ſame with the *Annularis Proceſſus.*



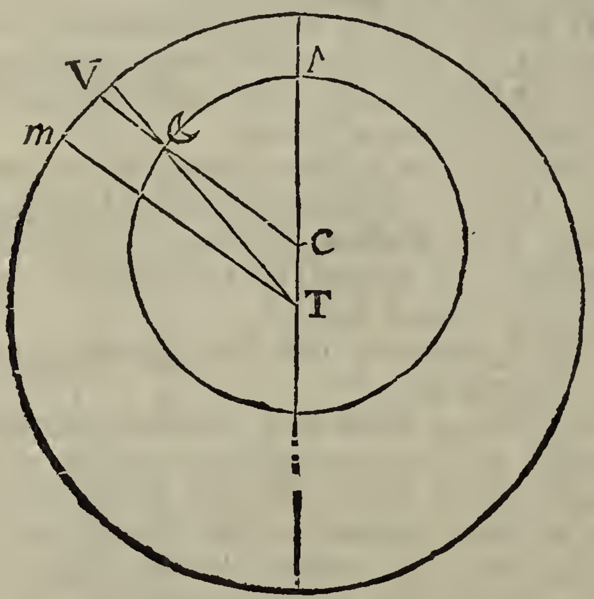
ANNULET, a little Ring, which in *Heraldry* is the Mark of Diſtinction which the Fifth Brother of any Family ought to bear in his Coat of Arms. *Annulets* are alſo Part of the Coat-Armour of ſeveral good Families.

ANNULETS, [in *Architecture*,] are ſmall ſquare Parts turned about in the *Corinthian Capital*, under the *Echinus* or Quarter-round; or it is a narrow flat Moulding which is common to other Parts of a Column, the Baſes, &c. as well as the Capital; and is the ſame Member that is ſometimes called the *Fillet*, *Coincture*, *Liſt*, *Tince*, *Square*, *Rabbit*, and *Supercilium.*

ANODYNES, [Ἀνωδυνὴ, of *α priv.* and ὠδυνὴ, *Gr. Pain,*] in *Medicine*, are ſuch Remedies as aleviate or quite take away Pain. They are ſometimes alſo called *Paragoricks*, from the Comfort and Quiet that they procure to the Patient: If they are of ſuch a Nature as to produce Sleep, they are called *Hypnoticks*; if they ſtupify and take away the Senſe of Pain, they are called *Narcoticks.*

ANOMALISTICAL *Year*, [*Aſtronomy*,] is the Space of Time that the Earth paſſes through her Orbit.

ANOMALY, [Ἀνωμαλία, *Gr. an Irregularity,*] is an Inequality or Irregularity in the Motion of the Planets. In the *Philoſophical Tranſactions*, *N.* 57. you have a Way to find it Geometrically by Mr. *Caſſini*. The Word *Anomaly* is ſometimes uſed to ſignify the *Argument* of the Irregularity, and the *Equation* which ſhould adjuſt it. This Irregularity is moſt conſiderable in the Moon's Motion, and it muſt be adjuſted before the exact Time of her Conjunction with the Sun can be found; and conſequently an Eclypſe truly calculated.



The Angle *A C* ☾, or its Equal *A T M*, is the *Argument*, or the *mean Adomaly* of the *Moon*; and the Angle *A T* ☾ is the *true* or *co-adequated Anomaly*: See *Mercator*'s *Aſtronomy*, p. 69.

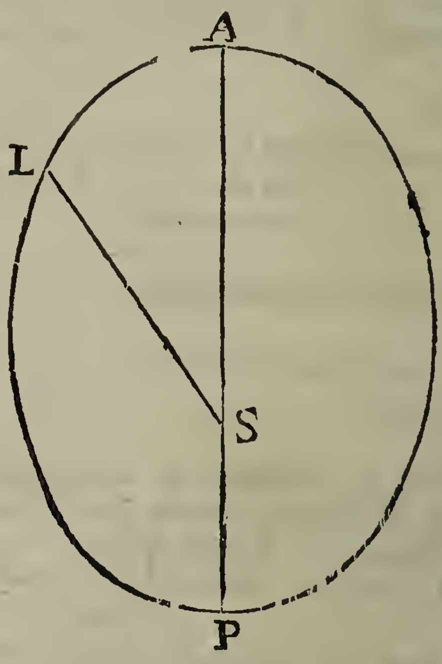
ANOMALY *of the Orbit*, is the Arch or Diſtance of a Planet from its *Aphelion.*

The *Mean* ANOMALY *of the Centre*, in the *Ptolemaick Theory of the Planets*, is an Ark of the *Zodiack* of the *primum Mobile* terminated by the *Linea Apſidum*, and by the Line of the *mean Motion of the Centre.*

The *true* ANOMALY *of the Centre*, is the ſame Ark of the *Zodiack* terminated by the Lines of the *Apſes*, and by the Line of the *true Motion of the Centre.*

ANOMALY, (*true or equal*) of a Planet, is an Ark of the Eccentrick comprehended between the true Place and the *Apogee.*

ANOMALY, (*mean or equable*) of a Planet, in the *New* or *Elliptical Aſtronomy*, is the *Area* contained under the Line *S L* drawn from the Sun to the Planet, under *S A* and *L A*, computed from *S A*, *in Conſequentia*, or according to the natural Order of the Signs. They call it the *Equable*, *Mean*, or *Middle Anomaly*, becauſe this *Area* increaſes equably, or in Proportion to the Time of the Planets Revolution round the Sun in the *Focus S.*



The Angle *A S L* under the Line of the *Apſes A P*, and the Line *L S*, which is that of the Planet's Motion, is called the *Anomaly co-æquated*, or *true*, in this *Aſtronomy.*

ANOMALY, (*Mean*) of the Sun or other Planet, (in the *Old Aſtronomy*,) is an Ark of the Ecliptick between its *mean* Place and Apogee. This is called the *Argument.*

ANOMALY, is alſo uſed by the *Grammarians*, and is applied to ſuch Words as do not in their Formation or Variation, agree with a common Rule; as *do*, *dedi*, *datum*, where the *Imperfect Tenſe* and the *Participle* are both *Anomalous*, that is, *Irregular.*

They reckon four Kinds of *Anomalous Nouns*; *Heterogeneous*, *Heteroclites*, *Deficients*, and *Redundants* or *Abundants*; which ſee.

ANOMALOUS, [Ἀνόμαλος, of *α Neg*, and ὅμαλος, *Gr. equal,*] is the ſame with *Irregular*, and is ſpoken of a Motion in the Planets that is unequal or irregular.

ANOMPHALOS, [of *α Priv.* and ὀμφαλος, *Gr. a Navel,*] one who is without a Navel, as our firſt Parents *Adam* and *Eve* are ſuppoſed to have been created, they not having ſtood in Need of any Nouriſhment that Way.

ANONYMOUS, [Ἀνώνυμος, *Gr.*] *Nameleſs*, to which no Name is affixed. Mr. *Boyle* finding by Experiment, that a Spirit was inſeparable from *Tartar*, and ſeveral *Woods*, which in many Qualities differed both from the *Vinous*, *Acids*, and *Urinous ones*, and having not fully diſcovered its Nature, he called it by this Name *Anonymous*, and ſometimes the *Neutral* or *Adiaphorous* Spirit of *Tartar*, *Wood*, &c.

ANOPSY, is Want of Sight, or Blindneſs.

ANOREXY, [Ἀνορεξια, *Gr.*] is a Loathing of Meat, ariſing from an ill Diſpoſition of the Stomach.

ANOYSANCE, the ſame with *Nuſance.*

ANSES, or ANSÆ, the ſame with the *Ring of Saturn*; ſo called, becauſe they ſometimes appear like Handles to the Body of the Planet. See *Ring.*

Anno 1668, *Aug.* 17, 11 *h.* 13 *min. poſt Mer.* Mr. *Hugens* and Mr. *Picart*, by the Help of a Twenty-one Foot Teleſcope, found the Inclination of the great Diameter of the *Ring of Saturn*, with the *Equator*, to be about 9 Degrees; whence they inferred, the Angle of the Plane of the Ring, with that of the Ecliptick, muſt be about 31 Deg. See *Saturn.*

ANTAGONIST, [Ἀνταγωνιστὴς, of ἀντὶ *againſt* and ἀγωνίζω, *Gr. to ſtrive,*] he that in Diſputation or Arguing oppoſes another.

ANTAGONISTA, is a Muſcle placed oppoſitely to another; as may be ſeen betwixt the *Adductor* and *Abductor*, that which contracts, and that which expands the Arm.

ANTAPHRODITICKS, (of ἀντὶ and ἀφροδίτη, *Gr. Venus,*) Medicines good againſt the *Venereal Diſeaſe.*

ANTAPHRODISIACK [of ἀντὶ and ἀφροδισιος, *Gr.*] *Venereal.*

ANTARES, the *Scorpion*'s *Heart*, a fixed Star of the firſt Magnitude in the Conſtellation *Scorpio*; its Longitude is 245°. 13′. Latitude 4°. 27′.

ANTARCTICK *Pole*, is the Southern Pole, or End of the Earth's *Axis*; 'tis ſo called, becauſe oppoſite to the *Arctick* or North Pole.

ANTARCTICK *Circles*: See *Polar Circles.*

ANTARTHRITICK *Medicines*, are ſuch as are uſed againſt the *Gout.*

ANTASTHMATICK *Medicines*, are ſuch as are uſed againſt the *Aſthma.*

ANTECEDENCE IN, or *in Antecedentia*: The *Aſtronomers* ſay, a Planet is in *Antecedence*, when it appears to move contrary to the uſual Courſe or Order of the Signs of the *Zodiack*, as when it moves from *Taurus* towards *Aries*, &c. but if it go from *Aries* to *Taurus*, and thence to *Gemini*, &c. they ſay it goes *in Conſequentia*, or *in Conſequence.*

ANTECEDENT, [in *Logick,*] is the firſt of the two Propoſitions in an *Enthymema*, as the latter is called the *Conſequent.*

ANTECEDENT, [in *Mathematicks,*] is the former of two Terms in Proportion, or that which is compared with the other; thus, if the Proportion were of *A* to *B*, *A* is ſaid to be the *Antecedent.*

ANTEPENULTIMA, [in *Grammar,*] the third Syllable of a Word from the End, or the laſt Syllable but two.

ANTES, [in *Architecture,*] are ſquare Pilaſters which the Ancients uſed to place at the Corners of the Walls of their Temples.

ANTESTATURE, is a ſmall Retrenchment made of *Palliſadoes*, or Sacks of Earth ſet up in Haſte to diſpute with the Enemy the Remainder of a Piece of Ground, Part whereof hath been already gained.

ANTHELIX, [of ἀντὶ and ἕλιξ, *Gr. the outward Brim of the Ear,*] is the Protuberance of the Ear, or the inward Brink of the outward Ear, being a Semi-circle within the *Helix*, and almoſt parallel to it.

ANTHELMINTICKS, [of ἀντὶ and ἕλμινθος, *Gr. a Worm,*] are ſuch Medicines as deſtroy Worms.

ANTHERÆ, [of Ἄνθος, *Gr. a Flower,*] are thoſe little Tops or Knobs which grow on the Tops of the *Stamina* of Flowers, and are oftner called *Apices*; which ſee. Mr. *Ray* engliſhes them *Chives.*

ANTHOLOGY, is a Diſcourſe or a Treatiſe of Flowers, or the Art of a true Floriſt.

ANTHRACOSIS *Oculi*, is a corroſive ſcaly Ulcer in the Eye, attended with a general Tumour, eſpecially of the Parts about the Eye.

ANTHRAX, [Ἀνθραξ, *Gr. a Coal,*] *Carbo*, *Pruna*, or *Carbunculus*, is defined to be a Tumour that ariſes in ſeveral Places ſurrounded with hot, fiery and moſt ſharp Pimples, accompanied with acute Pains, but without ever being ſeparated; and when it ſpreads it ſelf farther, it burns the Fleſh, throws off Lobes when it is rotten, and leaves an Ulcer behind it, as if it had been burnt in with an Iron. *Blanchard.*

ANTIAPHRODITICKS, (of ἀντὶ *againſt*, and ἀφροδίτη, *Gr. Venus,*) are Medicines that allay Luſt.

ANTIARTHRITICKS, [of ἀντὶ and ἀρθρίτης, *Gr. the Gout,*] are Medicines againſt the *Gout.*

ANTIAS, in the Plural *Antiades*, are the Glands called the *Tonſills*, or the Almonds of the Ears.

ANTIASTHMATICKS, [of ἀντὶ and ἆσθμα, *Gr.*] Remedies againſt Shortneſs of Breath.

ANTIAXIOMATISM, [of ἀντὶ and ἀξίωμα, *Gr.*] that which oppoſes or contradicts any known *Axiom.*

ANTIBACHIUS, is a *Latin* Verſe whoſe Feet conſiſt of three Syllables, the two firſt long, and the laſt ſhort.

ANTICARDIUM, [of ἀντὶ and καρδία, *Gr. the Heart,*] the ſame with *Scrobiculus Cordis.*

ANTICTHONES, the ſame with *Antipodes.*

ANTICKS, [*Antiqua. L.*] in *Architecture*, are certain carved Works repreſenting divers odd Shapes of Men, Beaſts, Birds, Fiſhes, Flowers, *&c.* which being rudely determined and form'd one out of another, ſerve as an Ornament to the whole Fabrick, and afford a grateful Variety to the Eye of the Beholder.

ANTICNEMION, [of ἀντὶ and κνήμη, *Gr. the Tibia,*] the Skin or Fore-part of the *Tibia.*

ANTICHOLICA, [of ἀντὶ and χολικὴ, *Gr.*] Remedies againſt the *Cholick.*

ANTICHRONISM, [ἀντιχρονισμος, *Gr.*] a falſe Chronology.

ANTIDILUVIAN, is whatever was before *Noah*'s *Flood*: Thus thoſe Generations from *Adam* which were before the Flood, are called the *Antidiluvians*, as thoſe ſince deſcended from *Noah* are called the *Poſtdiluvians*. The Earth that then was before it was deſtroyed by the Flood, and which the ingenious and learned Dr. *Tho. Burnet* conceives to have been very different from ours in Form, Conſtitution, Figure, and Situation, is called the *Antidiluvian Earth.*

But Dr. *Woodward*, in his *Natural Hiſtory of the Earth*, undertakes to prove from a Series of Obſervations carefully made,

1. That the Face of the Earth before the *Deluge* was not, as the *Theoriſts* imagine, *ſmooth*, *even*, and *uniform*, but as it is now, *unequal*, diſtinguiſhed

ed into Mountains, Valleys, and Plains, as alſo having a Sea, Lakes, and Rivers.

2. That this *Sea* was *ſalt*, as ours is, *agitated by Tides*, *repleniſhed with Fiſhes of all Kinds*, and that the *Ocean* then was nearly of the ſame Extent, and poſſeſſed an equal Share of the Globe with the preſent one.

3. That the *Antidiluvian Earth* was ſtocked with Vegetables and Animals on all Sides, and in all Parts of it quite round the Globe; had both Metals and Minerals in it; had the ſame Poſition in Reſpect of the Sun which ours now hath, its *Axis* being not parallel, but inclined, as at preſent, to the Plane of the Ecliptick; and conſequently there were then the ſame Succeſſion of Heat and Cold, Wet and Dry, and the ſame Viciſſitudes of Seaſons, *Spring*, *Summer*, *Autumn*, and *Winter*, as there are now.

ANTIDINICA, [of ἀντὶ and δινὴ, *Gr. a Whirlwind*,] Remedies againſt Dizzineſs in the Head.

ANTIDOTE, [Ἀντίδοτος, *Gr.*] a Medicine againſt deadly Poiſon.

ANTIDYSENTERICKS, [of ἀντὶ and δυσεντερεία, *Gr.*] Medicines good againſt the Dyſentery, or Bloody Flux.

ANTIEPILEPTICKS, [of ἀντὶ and Επιλεψια, *Gr.*] are Remedies againſt the *Falling Sickneſs*.

ANTI-EMETICKS, [of ἀντὶ and ἐμετικὰ, *Gr.*] Remedies that ſtop Vomiting.

ANTI-HECTICKS, [of ἀντὶ and Ἑκτικος, *Gr.*] Remedies againſt an *Hectick Fever*, or *Conſumption*.

ANTI-HECTICUM *Poterii*, or *Jupiter*'s *Diaphoretick*, is a Chymical Medicine made by the Mixture of *Tin*, the Martial *Regulus* of *Antimony*, and fixed by *Saltpetre*. See the Operation in *Lemery's Chymiſtry*, laſt Edit. p. 117.

ANTI-HYPNOTICKS, (of ἀντὶ and ὑπνοτικὰ, *Gr.*) Medicines that drive away Sleep.

ANTI-HYPOCHONDRIACKS, [of ἀντὶ and ὑποχονδρεία, *Gr.*] are Medicines uſed againſt the *Hypochondriack Melancholly*.

ANTI-LOGARITHM, [Ἀντιλογαριθμὸς, *Gr.*] the Complement of the Logarithm of any *Sine*, *Tangent*, or *Secant* to 90 *Deg.*

ANTI-LOGY, [Ἀντιλογία, *Gr.*] is a Contradiction between any Words or Paſſages in any Author.

AMTI-METRICAL, (of ἀντὶ and μετρικὸς *Gr.*) is whatever is contrary to the Nature and Order of Metre or Verſe.

ANTIMONIUM *Diaphoreticum*, is made of one Part of *Antimony* and three of *Saltpetre*, powdered and mixed together, and thrown Spoonful by Spoonful into a red hot Crucible; a Detonation will follow each Spoonful: When all is put in, continue a great Fire about the Crucible for about two Hours; then throw the white Matter into an earthen Veſſel of fair Water, and leave it ſteeping warm for about two Hours, that all the *Saltpetre* may be diſſolved; then pour off the Liquor gently, and waſh ſeveral times the white Powder at the Bottom; which is the *Calx* of *Antimony*, or *Antimonium Diaphoreticum*. Some uſe it as a *Diaphoretick*; but *Lemery* ſaith, he could never find it would raiſe a Sweat.

ANTIMONIUM *Medicamentoſum*, is a Preparation conſiſting of five Ounces of *Antimony*, one Ounce of *Salt of Tartar*, and four Ounces of *Saltpetre* fluxed together into a *Regulus*, which is afterwards powdered and waſhed.

ANTIMONIUM *Reſuſcitatum*, is made of equal Parts of *Antimony* and *Sal Armoniack* ſublimed together three times; then the Sublimate is waſhed with diſtilled Vinegar warm to get out the Salts.

ANTINEPHRITICK, [of ἀντὶ and νεφριτικὸς, of νεφρὸς, *Gr.*] is a Medicine good againſt the Stone.

ANTINOMASY, [Ἀντινομασία, *Gr.*] is a Figure in *Grammar*, or rather *Rhetorick*, whereby an Appellative is uſed inſtead of a proper Name, as the *Philoſopher* inſtead of *Ariſtotle*, &c. and whatever is thus delivered or ſpoken, is ſaid to be ſo delivered or ſpoken *Antinomaſtically*.

ANTINOMY, [of ἀντὶ and νόμος, *Gr. a Law*,] is a Contradiction between two Laws.

ANTINOUS, [*Aſtronomy*,] a Part of the Conſtellation *Aquila*, or the *Eagle*.

ANTIOECI, are ſuch Inhabitants of the Earth as dwell one againſt another in the ſame Semicircle of the ſame Meridian, and in the ſame Degree of Latitude, but one *North*, the other *South*. Theſe have Noon and Midnight at the ſame time, but the Seaſons of the Year are contrary; as when the *Northern Antioeci* have their Summer, the *Southern* have Winter, *&c.* In one Word, they live under the ſame Meridian, but oppoſite Parallels.

ANTIPAGMENTS, [in *Architecture*,] are the garniſhing of Poſts or Pillars.

ANTIPARALYTICK, (of ἀντὶ and παράλυσις, *Gr.*) good againſt the *Palſy*.

ANTIPASIS, the ſame with the *Revulſion* of a Diſeaſe, when the Humours flowing into ſome one Part, are turned back again, and forced to take ſome other Courſe.

ANTIPATHY, (Ἀντιπαθεία, of ἀντὶ and πάθη, *Gr. Affection.*) a natural Averſion, a Contrariety of natural Qualities between ſome Creatures and Things. The Reaſon ſome account for the *Antipathy* between *Animals*, is as follows: That by the Sight of ſuch Objects, certain Impreſſions are tranſmitted through the Fibres of the Nerves into the Brain, which convey the animal Spirits into the Nerves; which upon the Blood being rarified after another Manner than is uſual, ſends thoſe Spirits into the Brain, which are adapted to the fomenting or cheriſhing of Terror. And again, as Effluvia and ſpirituous Steams proceed from the Bodies of all Creatures, ſome of which diſagree with others, they excite Hatred and Anger in each other.

ANTIPERISTASIS, (of ἀντὶ and περιίσταμαι, *Gr. to ſtand round*,) according to the *Peripateticks*, is a certain Invigoration of the internal Heat of any Body, by its being environed all round with Cold. They inſtance in *Lime* growing hot on the Effuſion of cold Water, *&c.*

ANTIPERISTALTICK, is a Motion by which the Excrements of the Guts are carried upwards inſtead of downwards, which is the uſual and natural *Periſtaltick Motion*. See that Word.

ANTIPHARMACUM, (of ἀντὶ and φαρμακὸν, *Gr.*) the ſame with *Antidote*, is a Medicine that expels Poiſon.

ANTIPHRASIS, (Ἀντιφρασις, *Gr.*) a figurative Speech, having a contrary Meaning to what it carries in Appearance.

ANTIPODES, (of ἀντὶ and ποδὸς *Gen.* of πȣ̃ς, *Gr. a Foot*,) are ſuch Inhabitants of the Earth as live diametrically oppoſite to one another, that is, in Parallels of Latitude equally diſtant from the Equator, but one *North*, the other *South*; and under the ſame Meridian, though 180 Degrees, or juſt half of that Meridian diſtant from one another.

ANTIPTOSIS, a Figure in *Grammar*, wherein one Caſe is put for another.

ANTISCII, is a Term in *Geography*, ſignifying ſuch Inhabitants of the Earth as live in two Places oppoſite to one another, one on the *North*, the other on the *South* Side of the *Equator*; ſo that their Shadows at Noon fall different Ways, one directly oppoſite to the other.

ANTISCION *Signs*, [*Aſtrology*,] Signs, which with Reference to one another, are equally diſtant from the two Tropical Signs *Cancer* and *Capricorn*; ſo that when a Planet is in ſuch a Station, it is ſaid to caſt its *Antiſcion*, i. e. to give a Virtue or Influence to another Star or Planet that is in the oppoſite Sign.

ANTISCIONS, [in *Aſtrology*,] certain Degrees in the *Zodiack* that anſwer one another.

ANTISCORBUTICKS, are Medicines againſt the *Scurvy*.

ANTISPASIS, [of ἀντὶ and σπάω, *Gr. to draw*,] the Revulſion of any Humour into another Part.

ANTISPASMODICKS, [of ἀντὶ and σπασμὸς, *Gr.*] Medicines againſt the *Cramp*, ſhrinking of the *Sinews*, or *Convulſions*.

ANTISPASTICKS, [of ἀντὶ and σπαστικὸς, *Gr.*] Medicines which divert Humours to other Parts.

ANTISPASTON, [Ἀντίσπαστος, *Gr.*] a Foot in *Greek* or *Latin* Verſe, which has the firſt Syllable ſhort, and the ſecond and third long.

ANTISTROPHE, [Ἀντιστροφὴ, *Gr.*] is a Figure in *Grammar*, whereby two Terms of Things which are mutually independent one upon another, are reciprocally converted; as if one ſhould ſay, the Maſter of the Servant, and the Servant of the Maſter.

ANTITASIS, (of ἀντιτάσσω, *Gr.*) an oppoſite placing of the Parts, as that of the Liver and Spleen, *&c.*

ANTITHENAR, one of the Muſcles that extends the Thumb.

ANTITHESIS, (in *Rhetorick*,) is a ſetting two things by Way of Oppoſition one againſt another, that ſo the Excellence of one, and the Evil and Folly of the other may the better appear.

ANTITRAGUS, (of ἀντὶ and τραγὸς, *Gr.*) a little Prominence at the lower End of the *Antihelix*, ſeated oppoſite to the *Tragus*, whence it has its Name.

ANTIVENEREAL, good againſt the *French Pox*.

ANTONOMASIA, (Ἀντονομασία, *Gr.*) a Trope in *Rhetorick*, is when the proper Name of one thing is applied to ſeveral others; or, on the contrary, the Name of ſeveral things to one.

By this *Trope* we call any voluptuous Perſon a *Sardanapalus*, and any cruel Perſon a *Nero*; for the one was a voluptuous King, and the other a cruel Emperor; or when we ſay, the *Philoſopher* has prov'd it in his *Metaphyſicks*; the *Orator* gives this Precept in his *Rhetorick*; we mean *Ariſtotle* and *Cicero*.

ANUS, is the Extremity of the *Inteſtinum Rectum*; it conſiſts of tree Muſcles, two called the *Levatores*, which diſtend and open the *Anus* in order to diſcharge the Excrements; and one called the *Sphincter*, which ſhuts it and keeps it ſo. There is alſo a Cavity in the Brain called *Anus*, which ariſes from the four Trunks of the *Spinal Marrow*; and by ſome the Skin which goes over the Navel in aged Perſons, being wrinkled, is called *Anus*.

AORTA, (of ἀέρω, *to lift up*, or ἀὴρ, *the Air*, and τηρέω, *Gr. to keap*,) or great Artery, ſo called, becauſe it is the greateſt Artery in the whole Body, from which all others (except the *Pulmonary*) are derived: It riſes immediately out of the left Ventricle of the Heart, and at its Riſe hath three Valves, which have the ſame Uſe and Figure as the *Semilunares* in the *Arteria pulmonaria*. As ſoon as the *Aorta* comes out of the Heart, it aſcends a little upwards, and then turns downwards to form the deſcending Trunk, becauſe the Blood might offend the Brain, if it ran with that Impetuoſity with which it is thrown out of the Heart; and from the upper Side of this Turning, the *Cervical* and *Auxiliary* Veſſels do ariſe: By this Artifice, as the Blood collides againſt the Sides of the *Aorta*, its Force is broken, Part of it is taken in by the Mouth of the aſcending Branches, but its greateſt Part is directed downwards. At the Riſe of the *Coronariæ* out of the *Aorta*, there is a Valve placed that permits the Blood to flow out of the great Artery into them, but hinders its Reflux. When it has pierced the *Pericardium*, and bended a little arch-ways backwards, it is divided into two Trunks, whereof the one is called *Truncus aſcendens*, the other *deſcendens*.

The *Aorta* hath four *Tunicks*, a *Nervous*, a *Glandulous*, a *Muſcular*, and a *Membranous* one, which is the *Internal*. See *Arteries*.

APAGOGICAL *Demonſtrations*, are ſuch as do not prove the thing directly, but ſhew the Impoſſibility and Abſurdity which ariſes from denying it; and therefore 'tis uſually called *Reductio ad impoſſibile, vel ad abſurdum*.

APATHY, (of α and πάθος, *Gr.*) is an utter Want of Paſſion; alſo an Inſenſibility of Pain.

APECHEMA, (of ἀπὸ and ἠχώ, *Gr.* an *Eccho*,) a Contra-fiſſure, when a Blow is given on one Side, and the Fracture made on the other.

APEPSY, (Ἀπεψία, *Gr.*) bad Digeſtion, or Rawneſs of the Stomach, when there is no good Concoction of the Aliments.

APERIENS *Palpebram Rectus*, is a Muſcle ſo called, from its ſtrait Progreſs and Uſe. It ariſes ſharp and fleſhy from the profoundeſt Part of the *Orbit*, near the Place where the Optick Nerve is tranſmitted, paſſing directly over the *Muſculus attollens*; it becomes tendinous as it marches over the Bulb of the Eye, whence growing ſtill broader and thinner, till it is inſerted to the whole ſuperior Part of the upper Eye-lid.

APERITIVE *Medicines*, or ſuch as open the obſtructed Paſſages in the ſmall Veſſels, Glands, or Pores, and by that Means promote a due Circulation of the contained Juices.

APERTIO *Portarum*, (*Aſtrology*,) *i.e.* an opening of the Gates; ſome great and manifeſt Change of the Air, upon certain Meetings of the Planets and Configurations. *L.*

APERTURA *Feudi*, a Term in the *Civil Law*, ſignifying the Loſs of a *Feudal Tenure*, by Default of Iſſue to him to whom the *Feud* was firſt granted or given.

APERTURE, in ſome Writers of *Geometry*, is the Inclination of one Right-line to another, which meet in a Point and form an Angle. And it is ſo called, becauſe the Angle is the *Opening* of the Legs of the Angle, like thoſe of a joint Rule.

APERTURE, (in *Opticks*,) is the Hole next the Object-glaſs of a Teleſcope or Microſcope, through which the Light and Image of the Object comes into the Tube, and thence is carried to the Eye. Mr. *Auzout* ſaith, He found that the *Apertures* of Teleſcopes ought to be nearly in a ſubduplicate Proportion of their Lengths.

The viſible *Area* of an Object is not increaſed or diminiſhed by the greater or leſſer *Aperture* of the Object-glaſs; all that is effected thereby, is the Admittance of more or leſs Rays, and conſequently the more bright or obſcure Appearance of the Object. When you look at *Venus* through a Teleſcope, you muſt uſe a much leſs *Aperture* than for the *Moon*, *Jupiter*, or *Saturn*, becauſe her Light is ſo vivid and glaring.

APETALOUS, (of *α priv.* and ϖέταλον, *Gr. a Leaf*,) *Flowers* or *Plants*, are by the *Botaniſts* accounted ſuch as want the fine coloured Leaves of Flowers which they call *Petala*; theſe Flowers are otherwiſe called *ſtamineous*, and are juſtly reckoned *imperfect.*

APEX, is the Top, Point, uppermoſt, or ſharpeſt Part of any thing.

APEX, (in *Geometry*,) the Top of a Cone, or any ſuch like Figure ending in a ſharp Point.

APHÆRESIS, (Ἀφαίρεσις, of ἀφαιρέω, *Gr. to take away*,) in *Grammar*, is that Figure which takes away a Letter or a Syllable from the Beginning of a Word, as *ruit* for *eruit.*

In *Surgery*, is that Part which teaches to take away Superfluities.

APHETA, (*Aſtrology*,) the Name of a Planet, which is taken to be the Giver or Diſpoſer of Life in a Nativity.

APHELIUM, or *Aphelion*, (of ἀπὸ and ἥλιος, *Gr. the Sun*,) or *Auge* in the *Copernican Hypotheſis*, is that Point of the Earth's or any other Planet's Orbit, in which it is the fartheſt diſtant from the *Sun* that it can ever be; and when it is at the neareſt Diſtance, it is ſaid to be in its *Perihelion.*

Sir *Iſaac Newton* proves the *Aphelia* of the Planets, as well as the Nodes, to be at reſt, *Prop.* 14. *Book* 3.

In *Pholoſ. Tranſ. N.* 128, is a ſtrict Geometrical Method for finding the *Aphelia* of the Planets, by Mr. *Halley*.

APHORISM, is a general Rule, or eminent but ſhort Obſervation, experienced for a Truth in any Art, or relating to Practice.

APHTHÆ, (ἄφθαι, *Gr.*) are Wheals, Ulcers, or Pimples about the internal Parts of the Mouth; as alſo about the Ventricle and Guts; which when they come to be ripe, fall off by piece-meal, and are often accompanied with a Fever in thoſe of riper Years. Infants are often ſubject to the *Aphthæ*, they begin in the Gums, and by Degrees ſpread over the whole Palate and Mouth; if they ſeize the *Epiglottis*, and the upper Parts of the Throat, the Child ſeldom recovers. Theſe are called *Aphthæ* of *Celſus.*

APHYXIA, (ἀφυξία of ἀφύξω, *Gr. to draw out*,) a Ceſſation of the Pulſe through the whole Body, being the higheſt Degree of Swooning next to Death.

APICES, *of a Flower*, are thoſe little Knobs that grow on the Tops of the *Stamina*, in the Middle of the Flower; they are commonly of a dark purpliſh Colour. By the Microſcope they have been diſcovered to be, as it were, a ſort of *Capſulæ ſeminales*, or *Seed Veſſels*; containing in them ſmall globular, and often oval Particles, of various Colours, and exquiſitely formed, as I have often with Admiration obſerved my ſelf: In the Plant called *Germanium Robertianum*, or *Herb Robert*, theſe *Apices* are of a deep purple Colour, and the pulviſcular Matter within of a glorious yellow; they are exquiſitely ſpherical, and afford a very pleaſant Proſpect in a Glaſs.

What the Uſe of theſe ſo finely elaborated Particles is, is not yet, that I know of, diſcovered: Some have gueſſed it to be a kind of *Male Sperm*, which falling down into the Flower, they will have to help foecundate and ripen the Seed; but this I take to be a meer Fancy.

APLANES, Ἀπλανὴς, *Gr.* i. e. *ſettled*, *free from rambling*,) the Fixed Stars, ſo called in Oppoſition to the Planets.

APNOEA, (ἀϖνοία, of *α priv.* and πνέω, *Gr. to breathe*,) a Depravation and Diminution, or an entire Suppreſſion of Breathing, at leaſt to Senſe, as it happens in Swoonings, Fits of the Mother, and ſtrong Apoplexies.

APOCATHARSIS, (Ἀποκαθάρσις, *Gr.*) a Purging both upwards and downwards.

APOCHYLISMA, (of ἀπὸ and χυλισμὸς, *Gr.*) is any Juice boiled and thickened with Honey or Sugar into a Kind of hard Conſiſtence. This is called alſo *Rob. Rubab*, and *Succago.*

APOCOPE, (a Figure in *Grammar*, wherein the laſt Letter of a Word or Syllable is cut off.

APOCRISIA, (of ἀποκρίνομαι, *Gr.*) a Voiding or Ejection of Superfluities out of the Body.

APOCROUSTICKS, are, according to ſome Phyſicians, ſuch Medicines as hinder the Influx of the Humours to any particular part of the Body, and reject thoſe which are beginning to flow thither.

APODACRITICA, (of ἀποδακρύω, *Gr. to drop like Tears*,) Medicines which provoke Tears.

APODICTICAL *Argument* or *Syllogiſm*, ſignifies a plain Proof or Demonſtration of a thing.

APODICTICK, the ſame with *Apodictical.*

APODIOXIS, (ἀποδιόξις, *Gr.*) a Figure in *Rhetorick*, wherein any Argument or Objection is with Indignation rejected as abſurd.

APOGEE, or *Apogæum*, (ἀπόγαιον, *Gr.* of ἀπὸ, and γαῖα, or γῆ, *the Earth*,) in *Aſtronomy*, is the fartheſt Diſtance that any Planet can be at from the Earth in its whole Revolution; as *Perigæum* is its neareſt Diſtance.

How to find both *Apogæum* and *Perigæum*, ſee the Geometrical Method of *Caſſini*, with ſome Conſiderations upon it by Mr. *Mercator*, in *Philoſ. Tranſ. N.* 57.

APOGEE of the *Equant*, is the fartheſt Diſtance of it from the Earth, or the Point where the Circumference of the *Equant* is interſected by the *Linea Apſidum* in the remoteſt part of the Diameter; as the *Perigee of the Equant* is the oppoſite Point of the neareſt part of the Diameter.

The *Mean* APOGEE *of the Epicycle*, is a Point where the *Epicycle* is cut above by a Right-line drawn from its Centre to the Centre of the *Equant*, or the Point of the *Epicycle* moſt remote from the Earth.

APOLEPSY, (Ἀϖολεψία, *Gr.*) a Stoppage in the Courſe of the Blood or animal Spirits.

APOLOGETICAL, (Ἀϖολογητικὸς, *Gr.*) is what is ſaid or written by Way of Excuſe or Apology for any Action.

APOLUSIS, (Ἀϖόλυσις, *Gr.*) the Excluſion of any thing, as of the Birth, the *Fæces*, or the like; a Kind of Relaxation, by Means of which the whole is debilitated.

APOMECOMETRIE, (of ἀπὸ and μετρέω, *Gr.*

to meaſure,) is an Art teaching the Practicer how to meaſure things at a Diſtance, *viz.* how far they are off from him.

APONEUROSIS, (*Ἀπονεύρωσις*, *Gr.*) is, with *Anatomiſts*, the Spreading or Extenſion of a *Nerve* or *Tendon* out in Breadth in the Manner of a Membrane; alſo the cutting off a *Nerve* or *Tendon*, is ſo called.

APOPHLEGMATICAL *Medicines*, are ſuch as are endowed with the Faculty of drawing cold pituitous Humours from the Head, and diſcharging them by the Noſe or Mouth.

APOPHTHORA, (Ἀποφθορὰ, *Gr.*) an Abortion, the bringing forth a Child putrified in the Womb.

APOPHYGE, (Ἀποφυγὴ, *Gr.*) in *Architecture*, ſignifies that part of a Column where it ſeems to fly out of its Baſe, like the Proceſs of a Bone in a Man's Leg, and begins to ſhoot upward. But this *Apophyge* is really no more than the Rings or Ferrils heretofore faſtened at the Extremities of wooden Pillars, to keep them from ſplitting, and afterwards imitated in Stone Work.

APOPHYSES *mammillares*, (*Anatomy*,) are the Beginning of the olfactory Nerves as far as the *Os cribroſum*, where they divide into ſmall Fibres, which paſs through thoſe Bones, and ſpread throughout the upper part of the Noſe.

APOPHYSIS *mammillaris*, } (*Anatomy*, one of
APOPHYSIS *maſtoideus*, } the external Eminences of the *Os petroſum*.

APOPHYSIS, is a Protuberance made by the Fibres of a Bone, produced above its Superficies, and is ordinarily upon the Extremity of the Bones.

APOPLEXY. *It is a ſudden Deprivation of all internal and external Senſation, and of all Motion, unleſs one of the Heart and Breaſt*: For the underſtanding of which, it is neceſſary to premiſe, that if by any Means a Nerve is tied or compreſſed, the Part to which that Nerve is directed loſes its Senſe and Motion; that if any Nerve is cut, there diſtills out a Liquor; that Motion is performed by reaſon the nervous fluid is impelled by the Force of the arterial Blood through the Nerves into the muſcular Fibres; and that Senſation is from hence, that Objects compreſs or ſtrike upon the Extremities of the Nerves by their Motions, and drive back the nervous Fluid towards the Brain. An *Apoplexy*, therefore, is produced by any Cauſe which hinders ſuch Undulation of all the Nerves, unleſs thoſe which are deſtined to move the Heart and Breaſt. But the Means by which the Motion of the Heart and *Thorax* remain, or of the Pulſe and Reſpiration, when the other Parts are deprived of their Motion, is becauſe in every Motion which is performed by Muſcles having Antagoniſts, a Quantity of nervous Fluid muſt be derived into the contracting Muſcle, not only equal to that which is derived at the ſame time into the oppoſite Muſcle, but alſo greater; for otherwiſe the Part to be moved would remain in an *Equilibrium*, without Motion: And therefore more of the nervous Fluid muſt paſs into a Muſcle that has an Antagoniſt, than that which has none. But the Heart is a Muſcle that has no Antagoniſt, and conſequently requires a leſs Quantity of nervous Fluid to continue its Motion, than other Muſcles deſtined for the Motion of the Limbs; therefore if the Cauſe hindering the Undulations of all the Nerves, is ſuch that no Juice could flow through the Nerves, the Heart it ſelf would ceaſe from Motion, and Death enſue. But if the Cauſe be not ſo powerful as to take away all the Motion of the Fluid through the Nerves, but ſo far only reſiſt their Dilatation, that but a very little Fluid can paſs through them, not ſufficient to inflate thoſe Muſcles which have Antagoniſts, then thoſe Muſcles only will be contracted, which require the leaſt Quantity of Spirits, and ſuch is the Heart. The Impediment to ſuch due Undulation is generally a Repletion, and indicates Evacuation, joined with *Stimuli*.

APORE, (Ἄπορον, of *α priv.* and πόρος, *Gr. a Paſſage*,) in *Mathematicks*, is a Problem which tho' it be not impoſſible, yet it is very difficult to be reſolved, and hath not yet actually been ſo: Thus the Quadrature of the Circle may be called an *Apore*, becauſe there is yet no Way or Path diſcovered to lead us into it.

APORIA, (Ἀπορία, *Gr.*) a Rhetorical Figure, where the Orator is at a Stand what to do, as, *Shall I ſpeak out, or ſhall I be ſilent?*

APORIME: See *Porime*.

APORRHEÆ, } (of ἀποῤῥέω, *Gr. to flow out*,)
APORRHOÆ, } are Vapours and ſulphureous *Effluvia* which exhale through the Pores of the Body.

APORRHEAS, a Word uſed by Mr. *Boyle* for *Effluvia*; of the ſame Senſe with the former.

APOSIOPESIS, (*Ἀποσιώπησις*, *Gr.*) a Figure in *Rhetorick*, is, when on a ſudden a Perſon changes his Paſſion, cutting off his Diſcourſe, ſo that the Hearer cannot eaſily imagine what it is he intends; as it is very common upon Occaſion of threatning, to ſay, *If I*—— &c. *But*, &c. ——

APOSPASMA, (Ἀπόσπασμα, *Gr.*) the drawing of one part from another which naturally ſtuck to it; as when the Skin is ſeparated from a Membrane, a Membrane from a Muſcle, &c.

APOSTARE *Leges*, and *Apoſtatare Leges*, ſignifies wilfully to break or tranſgreſs the Laws.

APOSTATA *Capiendo*, is a Writ directed to the Sheriff, for to take the Body of one, who having entred into, and profeſſed ſome Order of Religion, leaves it and departs from his Houſe, and wanders about the Country.

APOSTROPHE, (Ἀποστροφὴ, of ἀποστρέφω, *Gr. to turn away from*,) is an Accent in *Grammar*, ſhewing there is a Vowel to be rejected, and is expreſſed thus (') and placed over the Head of the Letter. *Voſſius* writes it *Apoſtrophus*.

APOSTROPHE, is alſo a Figure in *Rhetorick*, when the Speaker in an extraordinary Commotion, turns himſelf on all ſides, and addreſſes himſelf to all Beings, whether ſenſible or inſenſible; whom he, for the preſent, ſuppoſes to be equally capable of hearing his Complaint, and of returning an Anſwer to his Demands.

APOSYRMA, (Ἀπόσυρμα, *Gr.*) a ſhaving of the Skin, or of a Bone.

APOTELESM, (Ἀποτελέσμα, *Gr.*) a Declaration of the Signification of the Stars in a Nativity; a Calculation of a Nativity.

APOTOME, (Ἀποτομὴ, of ἀποτέμνω, *Gr. to cut off*,) in *Mathematicks*, is an irrational Remainder, or reſidual Root; when from a *Rational Line*, as ſuppoſe a, you cut off a part, as b, which is only *commenſurable in Power* to the whole Line. Then it is expreſs'd thus, $a - \sqrt{b}$, and is called *Apotome*, becauſe it ſignifies a Remainder left by cutting off b.

APOZEME, (Ἀπόζημα, *Gr.*) is a Decoction of Roots, Woods, Barks, Herbs, Flowers, Fruits, Seeds, &c. which is boiled down commonly to twelve, fifteen, or twenty Ounces. It is either purging, looſening, altering, or drying: *cephalick*, *ſtomachick*, *diuretick*, *ſplenetick*, or *hepatick*, according as the Indications of the Diſeaſe direct.

APPARATUS, is uſed to ſignify the Utenſils pertaining to a Machine; as the *Apparatus* of an *Air-pump*, *Microſcope*, &c.

APPARATUS, (with *Surgeons*) the Bandages, Medicaments for dreſſing of a Wound, *&c.*

APPARATUS *Major* and *Minor*, (with *Lithotomiſts*) the greater and leſſer Preparation; two different Methods of cutting for the Stone.

High Apparatus, is performed by making an Inciſion above the Groin, along the *Linea alba*, into the Fund of the Bladder, and extracting the Stone through that.

The *Small* or *Low Apparatus*, is performed by thruſting the two Fore-fingers up the Fundament, till they touch or come againſt the Stone, and with them drive it to the Neck of the Bladder, and extract it from thence through an Inciſion in the *Perinæum*.

APPARENT *Conjunction*: See *Conjunction Apparent*.

APPARENT *Horizon*: See *Horizon*.

APPARENT *Place of a Star*, is a Point determined by a Line drawn from the Eye through the Centre of the Star; whereas the true or real Place is determined by a Line drawn from the Centre of the Earth to the Star or Planet.

APPARENT *Place of any Object*, (in *Opticks*,) is that (different from the real one) in which it appears when ſeen through one or more Glaſſes: For, when by Refraction through Glaſſes, that Parcel of Rays which fall on the Pupil of the Eye from each Point of any near Object, is made to flow as cloſe together as that which comes from a diſtant one; or when by the ſame Way, the Rays coming from diſtant Objects are made to *diverge* as much as if they flowed from nigh ones, then the Eye muſt neceſſarily ſee the Place of the Object changed; which Change is its *Apparent Place*.

If an Object be placed nearer to a Convex Glaſs than is the Diſtance of its *Focus*, its *apparent Place* may be determined; as Mr. *Molyneux*, *in Dioptr. p.* 116. ſhews.

But if the Object be in the *Focus* of the Glaſs, the *Locus apparens* of the Object cannot be determined; only, as Dr. *Barrow* ſaith, it will appear vaſtly remote.

Nor can the *Locus apparens* be determined, if the Object be beyond the *Focus* of a Convex Glaſs. But if an Object be more diſtant from a Convex Glaſs, than its *Focus* and the Eye lie beyond the *diſtinct Baſe*, the *apparent Place* of the Object will be in the *diſtinct Baſe*.

Heir APPARENT, one whoſe Title is clear beyond Diſpute or Contradiction.

APPARENT *Conjunction*, (in *Aſtronomy*,) is when the Right-line, ſuppoſed to be drawn through the Centres of two Planets, does not paſs through the Centre of the Earth, but through the Spectator's Eye.

APPARENT *Horizon*, (*Aſtronomy*,) that great Circle which limits our Sight; or that Place where the Heavens and Earth ſeem to us to meet.

APPARENT *Colours* (according to the old *Natural Philoſophy*,) thoſe Colours that are often ſeen in the Clouds before the Riſing, or after the Setting of the Sun; or thoſe in the Rainbow, *&c.*

APPARENT *Diameter of the Sun*, *Moon*, *or any Planet*, is the Quantity of the Angle that their Diameters appear under to an Obſerver on the Surface of the Earth.

The *apparent Diameter* of the Sun is now obſerved to be leaſt when he is in *Cancer*, and greateſt when in *Capricorn*. And in the Moon there is a two-fold Increaſe and Decreaſe of her *apparent Diameter*; the one when ſhe is in the *Conjunction* and *Oppoſition* with the Sun. and the other in her Quadratures. The greateſt *apparent Diameter* of the Sun, according to Mr. *Caſſini*, is 32′. 10″. and the leaſt 31′. 38″: and according to Mr. *de la Hire*, the greateſt is 32′. 43″. and the leaſt 31′. 38″.

The greateſt *apparent Diameter* of the Moon, according to *Kepler*, is 32′. 44″. and the leaſt 30′. 00″.; and according to Mr. *de la Hire*, the one is 33′. 30″. and the other 29′. 30″.

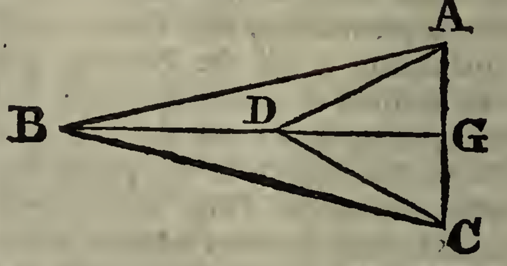
The greateſt and leaſt *apparent Diameters* of the five Planets, according to *Hevelius*, are as in the following Table.

	Greateſt.			*Leaſt.*		
	′	″	‴	′	″	‴
Saturn	0	19	40	0	14	11
Jupiter	0	24	12	0	14	36
Mars	0	20	50	0	2	46
Venus	1	5	58	0	9	34
Mercury	0	11	48	0	4	4

And the *apparent Diameter* of *Saturn's Ring*, according to Mr. *Hugens*, is 1′. 18″. when leaſt.

If the Diſtances of any two very remote Objects (as for Example, the Planets) be equal, their *true Diameters* are proportional to the *apparent* ones; and if the *apparent Diameters* are equal, the *true Diameters* will be as the Diſtances from the Eye of the Obſerver. Therefore, when neither the *Diſtances*, nor the *apparent Diameters* are equal, the *true Diameters* will be in a *Ratio* compounded of the direct *Ratio* of the *Diſtances*, and of the direct *Ratio* of the *apparent Diameters*.

APPARENT *Magnitude of an Object*, is the Quantity of the optick Angle; as the *apparent Magnitude* of the Object *A C*, ſeen from *D*, is the Quantity of the Optical Angle *A D C*, and when ſeen from *B*, the Quantity of the Optick Angle *A B C*.



The *apparent Magnitudes* of the ſame Object *A C*, ſeen at the Places *D* and *B*, that is, the Angles *A D C* and *A B C* are in a *Ratio* leſs than the reciprocal *Ratio* of the Diſtances *D G* and *B G*; but when the Object is very remote, *viz.* when the Optick Angles *A D C* and *A B C* are not above one or two Degrees, they are nearly in that *Ratio* reciprocally.

APPARLEMENT, (in *Common Law*,) Likelihood, Likeneſs or Reſemblance; as *Apparlement of War*.

APPEAL, [*Appel*, *F.* of *Appellatio*, *L.*] the removing a Cauſe from an inferior Judge or Court to a ſuperior, in order to rectify ſomething amiſs in a Sentence paſſed by an inferior Judge. It is alſo an Accuſation or Declaration of the Crime of any Perſon, particularly, the accuſing of a Murderer by a Perſon who is intereſted in the Perſon murdered.

APPEAL *by Bill*, [in *Law*,] is where a Man of himſelf gives up his Accuſation in Writing, offering to undergo the Burthen of appealing the Perſon therein named.

APPEAL by *Writ*, [in *Law*,] is when a Writ is purchaſed out of Chancery by one to another, to the Intent he appeal a third Perſon of ſome Felony committed by him, finding Pledges that he ſhall do it.

APPEAL of *Mayhem*, [in *Law*,] is an accuſing of one that hath maimed another: But that being no Felony, the Appeal is but a Kind of Action of *Treſpaſs*, becauſe there is nothing recovered but Damages.

APPEAL *of wrong Impriſonment*, a Term in Law, is by ſome uſed for an Action of wrong Impriſonment.

APPEARANCE, [in *Law*,] is the Defendant's engaging to anſwer a Cauſe or Action entred againſt him in ſome Court of Judicature.

APPELLANT, is he that brings an Appeal.

APPELLATIVE, (a Term in *Grammar*,) ſignifying a Name in Oppoſition to proper, and which belongs to a whole Species or Kind, as *Man*, *Chymiſt*, &c.

APPELLEE, one who is appealed againſt or accuſed.

APPELLOR, or *Appellant*, the ſame with *Approver*; one who having confeſſed a Crime, appeals, *i. e.* accuſes others who were his Accomplices.

APPENDANT and *Appurtenant*, [in *Law*,] are Things that by Time of Preſcription have belonged, appertained, and are joined to another principal thing, by which they paſs and go as acceſſary to the ſame ſpecial thing, as Lands, Commons, &c. to a Manor; Courts, Ways, &c. to a Houſe, Office, or ſuch others.

APPENDICULA *Vermiformis*, ſo ſome Anatomiſts call the *Inteſtinum Cœcum*, or Blind Gut, from its Figure and Manner of Situation, which in ſome Animals hangs pendulous like a Worm, and is not filled with Excrement, as it is in others.

APPENDIX, the ſame with *Epiphyſis*.

APPENSA, the ſame with *Periapta*, ſuch things as are hung about the Necks of diſeaſed Perſons, to free them from ſome Diſtempers which they labour under; ſuch as dried Toad to ſtop Bleeding, Peony Roots for Convulſions, &c.

APPENSURA, [*Old Rec.*] the Payment of Money at the Seal, or by Weight.

APPERTINANCES, }
APPURTENANCES, } ſignify (in the *Common Law*) Things both Corporeal, belonging to another thing as the more principal; as Hamlets to a chief Manor, Common of Paſture, Turbary, Piſcary, and ſuch like; and Incorporeal, as Liberties and Services of Tenants.

APPETITE, [*Appetitus*, *L.*] the Deſire of Nouriſhment, or a Stomach to Victuals.

APPETITE, [by *Philoſophers*,] is defined to be a Deſire of enjoying ſomething wanted; or a Complacency in the Enjoyment of a thing preſent; and is diſtinguiſhed into *Voluntary* and *Natural*.

Voluntary Appetite, is the Will it ſelf acting under a competent Knowledge or Information of the Matter in Hand, as the *Deſire of Happineſs*.

Natural Appetite, is a Sort of Inſtinct, whereby we are mechanically puſh'd on to conſult our own Preſervation.

APPLICATE, [in *Geometry*,] is a Right-line, otherwiſe called the *Ordinate* or *Semi-ordinate* in a *Conick Section*: See the Word *Ordinate*, or any Treatiſe of *Conick Sections*.

APPLICATE *Ordinate*, (a Term in *Geometry*:) See *Ordinate*. It ſignifies a Right-line applied at Right-angles to the *Axis* of any Conick Section, and terminated by the Curve.

APPLICATION, [in *Aſtrology*,] the approaching of two Planets one to the other.

APPLICATION, is ſometimes the Geometrical Term for Diviſion; the Reaſon of which ſee in *Geometrical Diviſion*. But *Application* alſo ſignifies the fitting or applying one Quantity to another, whoſe Area's, but not Figures, are the ſame. *Thus*, Euclid, *Book* 6. *Prop.* 28. *teaches how to a Right-line given, to apply a Parallelogram equal to a Rectilineal Figure given.*

APPLY, is a Term uſed by *Geometricians* in three Senſes.

1. It ſignifies to transfer a Line given into a Circle (moſt uſually) or into any other Figure, ſo that it ſhall be there fitted or *accommodated*, (which is alſo another Word they uſe for the ſame thing) according to its proper Length.

2. It is alſo uſed to expreſs Diviſion in *Geometry*, eſpecially by the *Latin* Writers, who, as they ſay, *Duc* 8 *in* 9, when whey would have 9 multiplied by 8; ſo they ſay, *Applica* 4 *ad* 12, when they would have 12 divided by 4: See *Diviſion Geometrical*, or in Lines, where the Reaſon of this Way of ſpeaking is explained.

3. It ſignifies alſo to fit Quantities whoſe *Area's* are equal, but Figures different, ſo that they ſhall conform to one another; as when *Euclid* in his ſixth Book, teaches how *on a Line given, to apply a Parallelogram equal to a Rectilineal Figure given.*

APPORTIONMENT, is a dividing into Parts a Rent which is dividable, and not entire or whole; and for as much as the Thing out of which it was to be paid is ſeparated and divided, the Rent alſo ſhall be divided, having Reſpect to the Parts.

APPORTUM, [in *Law*,] ſignifies Revenue, Gain, or Profit, which a Thing brings to its Owner.

APPOSAL of *Sheriffs*, is the charging them with Money received upon their Account in the *Exchequer*.

APPOSITION, [in *Grammar*,] is the putting of two or more Subſtantives together in the ſame Caſe.

APPRENDRE, [in *Law*,] ſignifies a Fee or Profit to be taken or received.

APPREHENSION, is the ſimple Contemplation of things that preſent themſelves to the Mind, as when we conſider the Sun, the Earth, a Tree, Rotundity, a Square, Cogitation, Entity, pronouncing nothing expreſly concerning them; and the Forms under which they are conſidered, are called *Ideas*.

APPROACHES, [in *Fortification*,] are Works caſt up on both Sides; ſo called, becauſe the Beſiegers by that Means may draw near a Fortreſs without Fear of being diſcover'd by the Enemy. Or *Approaches* are all ſorts of Advantages, by the Help of which an Advancement may be made towards a Place beſieged.

APPROPRIARE *Communam*, to diſcommon, that is, to ſeparate and encloſe any parcel of Land that was before open Common.

APPROPRIARE *ad Honorem*, a Term in *Law* ſignifying to bring a Man not within the Extent or Liberty of ſuch an Honour.

APPROPRIATION, is when the Advowſon of a Parſonage is given, or belongs to any Biſhoprick, Religious Houſe, College, *&c.* and to their Succeſſors, ſo that the Houſe or Body is both Patron and Parſon, and ſome one of the Members officiates as Vicar. 'Tis called *Appropriation*, becauſe the Profits of the Living are appropriated to the Uſe of the Patron.

APPROVEMENT, is where a Man hath Common within the Lord's waſte Ground, and the Lord encloſes part of the Waſte for himſelf, having nevertheleſs ſufficient Common with Egreſs and Regreſs for the Commoners. This Incloſing is called *Approvement.*

APPROVER, [in *Law*,] is he who hath committed ſome Felony, which he confeſſes; and to ſave himſelf, impeaches his Accomplice or Accomplices; and he is ſo called, becauſe he muſt *prove* that which he hath alledged in his Appeal.

APPROVERS *of the King*, are thoſe that have the letting of the King's Demeans in ſmall Manors, for the King's greater Advantage.

APPROXIMATION, [in *Arithmetick*, or *Algebra*,] is a continually coming ſtill nearer and nearer to the *Root* or *Quantity ſought*, without expecting to have it exactly. Of theſe Methods of *Approximations*, Dr. *Wallis* gives ſeveral Specimens in his *Hiſtory of Algebra*, p. 317. and ſome have been invented ſince: They are all nothing but a *Series infinitely converging* or approaching ſtill nearer to the Quantity required, according to the Nature of the *Series.*

In *Philoſoph. Tranſact. N.* 215. that excellent Mathematician hath a Diſcourſe about the Methods of *Approximation* in the Extraction of *Surd Roots*, in which he deſignedly ſhews the Grounds and Reaſons of the whole Buſineſs, and which therefore is very well worth the Reader's Peruſal; the Subſtance of what the Doctor delivers, is as followeth.

To begin with the Square Root.

From any non-quadrate Number or Quantity propoſed (ſuppoſe n) ſubtract, in the uſual Manner, the greateſt Square in Integers therein contained (ſuppoſe $a\,a$) the Remainder (ſuppoſe $b=2\,a\,e+ee$) is to be the Numerator of a Fraction, for deſigning the near Value of e the remaining Part of the Root ſought ($a+e=\surd n$) whoſe Denominator or Diviſor is to be $2\,a$ (the double Root of the ſubtracted Square) or $2\,a+1$ (that double Root increaſed by one) the true Value falling between theſe two; ſometimes the one, ſometimes the other, being neareſt to the true Value. But, for avoiding Negative Numbers, the latter is commonly directed.

The true Ground of the Rule is this; $a\,a$ being by Conſtruction, the greateſt Integer Square contained in n, 'tis evident that e muſt be leſs than 1, otherwiſe not $a\,a$, but the Square of $a+1$, or ſome greater than it, would be the greateſt Integer Square contained in n.) Now if the Remainder $b=2\,a+e\,e$ be divided by $2\,a$ the Reſult will be too great for e (the Diviſor being too little, for it ſhould be $2\,a+e$ to make the Quotient e.) But if to rectify this we diminiſh the Quotient by increaſing the Diviſor, adding 1 to it, it becomes too little, becauſe the Diviſor is now too big. For e being leſs than 1, $2\,a+1$ is more than $2\,a+e$, and therefore too big.

As for Inſtance; If the Non-quadrat propoſed be $n=5$, the greateſt Integer Square therein contained is $a\,a=4$ (the Square of $a=2$) which being ſubtracted, leaves $n-a\,a=5-4=1=b=2\,ae+e\,e$; which being divided by $2\,a=4$, gives $\frac{1}{4}$; but divided by $2\,a+1=4+1=5$, gives $\frac{1}{5}$; That too great, and this too little for e. And therefore the true Root ($a+e=\surd n$) is leſs than $2\frac{1}{4}=2,25$, but greater than $2\frac{1}{5}=2,2$: And this was anciently thought an *Approach* near enough.

If this *Approach* be not now thought near enough, the ſame Proceſs may be again repeated; and that as oft as is thought neceſſary.

Take now for a, $2\frac{1}{2}=2,2$, whoſe Square is $4,84=a\,a$ (now conſidered as an Integer in the ſecond place of Decimal Parts) this ſubtracted from 5,00 (or, which is the ſame, 0,84, the Exceſs of this Square above the former, from 1, which was then the Remainder) leaves a new Remainder $b=0,16$; which, divided by $2\,a=4,4$, gives $\frac{16}{440}=\frac{2}{55}=0,03636+$ too much: but divided by $2\,a+1=4,5$, it gives $\frac{16}{450}=\frac{8}{225}=0,5555+$, too little. The true Value between theſe two being 2,236 *proxime*, whoſe Square is 4,999696.

If this be not thought near enough, ſubtract this Square from 5,000000. The Remainder $b=0,000304$, divided by $2\,a=4,472$, or by $2\,a+1=4,473$, gives either Way 0,000068 −; which added to $a=2,236$, makes 2,236068 −, ſomewhat too big; but 2,236067 +, would be much more too little.

Which gives us the Square Root of 5, adjuſted to the ſixth place of Decimal Parts, at three Steps. And by the ſame Method, if it be thought needful, we may proceed further.

It were eaſy to compound the Proceſs of two or more Steps into one, and give, for the Rule, the Reſult of ſuch Compoſition, which would make it ſeem more intricate and myſterious, to amuſe the Reader.

In the Cubick Root, (conſonant to the Quadratick) the Rule is this:

From the *Non-Cubick* propoſed (ſuppoſe n) ſubtract the greateſt Cube in Integers therein contained (ſuppoſe $a\,a\,a$) the Remainder (ſuppoſe $b=3\,a\,ae+3\,a\,e\,e+e\,e\,e$) is to be the Numera. of a Fraction for deſigning the Value of e, (the remaining part of the Root ſought, $a+e=\surd n$). To this Numerator, if (for the Denominator or Diviſor) we ſubjoin $3a\,a$, the Reſult will certainly be too great for e, becauſe the Diviſor is too little: (For it ſhould be $3a\,a+3a\,e+e\,e$, to give the true Value of e). If for the Diviſor we take $3a\,a+3a+1$, it will certainly be too little, becauſe the Diviſor is too great. (For e by Conſtruction is leſs than 1.) It muſt therefore (between theſe Limits) be more than this latter; and therefore this latter Reſult being added to a, will give a Root whoſe Cube may be ſubtracted from the Non-Cubick propoſed in Order to another Step.

But if for the Diviſor we take $3a\,a+3a$, (or even leſs than ſo) the Reſult may be too great; or (in Caſe b be ſmall) it may be too little, and oft is ſo.)

Which comes to paſs from hence, becauſe e (by Conſtruction) is leſs than 1; and therefore $3a\,e$

leſs than $3a$; and perhaps ſo much, as that the Addition of ee will not redreſs it. And when it ſo happens, $3aa + 3a$ is a better Diviſor than $3aa + 3a + 1$, or even ſomewhat leſs than either. But becauſe it doth not always ſo happen, though for the moſt Part it doth, the Rule doth rather direct the other; as which doth certainly give a Root leſs than the true Value, whoſe Cube may always be ſubtracted from the Non-Cubick propoſed. The Deſign being to have ſuch a Cube, as, being ſubtracted, may leave another b to be ordered in like Manner for a new Approach. But for the moſt part, $3aa$ may be ſafely taken for the Diviſor: For though the Reſult will then be ſomewhat too big, yet the Exceſs may be ſo ſmall as to be neglected; or at leaſt we may thence eaſily judge what Number (ſomewhat leſs than it) may be ſafely taken; and if we chance to take it ſomewhat too big, the Inconvenience will be but this, that b for the next Step will be a Negative; of which Caſe we ſhall ſpeak anon.

Thus for Inſtance; if the Non-Cube propoſed be $9 - n$, the greateſt Integer Cube therein contained is $8 = aaa$ (whoſe Cubick Root is $a = 2$) which Cube ſubtracted, leaves $9 - 8 = 1 = b = 3aae + 3aee + eee$. This divided by $3aa = 12$, gives $\frac{1}{12} = 0{,}08333 +$, too big for e; but the ſame divided by $3aa + 3a + 1 = 12 + 6 + 1 = 19$, gives $\frac{1}{19} = 0{,}05263 +$, too little; or if but by $3aa + 3a = 2 + 6 = 8$ it gives $\frac{1}{18}, = \frac{5}{90} = 0{,}5555 +$, yet too little. For the Cube of $a + 0{,}06 = 2{,}06$, is but 8,742 —, which is ſhort of 9: And ſo much ſhort of it, that we may ſafely take 2,07 as not too big; or perhaps 2,08, which, (if it chance to be too big) it will not be much too big, as ſhall be farther ſhewn: And upon Trial it will be found not too big; for the Cube of 2,08, is 8,998912.

If this Step be not near enough, this *Cube* ſubtracted from 9,000000 leaves a new $b = 0{,}001085$, which divided by $3aa = 12{,}9796$, gives 0,000084 —, which will be ſomewhat too big, but not too much (for e is now ſo ſmall) as that $3ae$ may be ſafely neglected (and ee much more) ſo that if to 2,08 we add 0,000084 —, the Reſult 2,080084 will be too big, but 2,080083 will be more too little, as will appear if we take the Cube of each; ſo that either of them at the ſecond Step, gives the true Root within an Unit in the ſixth Place of Decimal Parts.

He ſays, (*taking the Cube of each*; which he does) that the Thing may be more clearly apprehended, but it is not neceſſary that we trouble our ſelves with the whole Cube: For aaa being already ſubtracted, for finding $b = 3aae + 3aee + eee$, we have no more to try, but whether $3aae + 3aee + eee$ be greater or leſs than b, according as we take 0,000084, or 0,0000083, for e.

Which may be conveniently done in this Manner: Take $3a + e$, and multiply this by e, or e by it, ſo have we $3ae + ee$; to this add $3aa$, and multiply the whole by e, ſo have we $3aae + 3aee + eee$, to ſee whether this be greater or leſs than b.

That is, in the preſent Caſe, if we take $e = 0{,}000084$, and add to this $3a = 6{,}24$, then is $6{,}240084 = 3a + e$: This multiply'd by $e = 0{,}000084$, is $3ae + ee = 0{,}000524 +$; to which if we add $3aa = 12{,}9792$, it is $3aa + 3ae + ee = 12{,}979724$, which multiplied again by $e = 0{,}000084$, is $0{,}0010902 +, = 3aae + 3aee + eee$, which is more than $b = 0{,}001088$.

But if we take $e = 0{,}000083$, and proceed as before, we ſhall have $3aae + 3aee + eee = 0{,}001077 +$, which is leſs than b, and therefore if we ſubtract that from this, the Remainder 0,000011, will be another b for the next Step, if you pleaſe to proceed further.

Hitherto we have purſued the Method moſt affected by the Ancients, in ſeeking a Square or Cube (and the like of other Powers) always leſs than the juſt Value, that it might be ſubtracted from the Number propoſed, leaving b a poſitive Remainder, thereby avoiding Negative Numbers.

But ſince the Arithmetick of Negatives is ſo well underſtood, it may in this, and other Operations of like Nature, be adviſable to take the next greater, in Caſe that be nearer to the true Value, rather than the next leſſer.

According to this Notion, for the Square Root of 5, I would ſay, it is $(2 +)$ ſomewhat more than 2, and enquire how much more? But for the Square Root of 8, I would ſay, it is $(3 -)$ ſomewhat leſs than three, and enquire, how much leſs? Taking in both Caſes that which is neareſt to the juſt Value.

Thus, in the Cubick Root before us, I take for e (in the laſt Enquiry) 0,000084 (where, for the near Step, we have $b = - 0{,}000002$) rather than 0,000083 + (where for the next Step, we ſhould have $b = + 0{,}000011$). In this latter Caſe we are to divide $b = + 0{,}000011$, by $3aa = 12{,}980236 -$, to find (by the Quotient) how much is to be added to 0,000083. In the other Caſe we are to divide $b = + 0{,}00002$, by $3aa = 12{,}980248$, to find (by the Quotient) what is to be abated of 0,000084, ſo have we $\frac{0{,}000011}{12{,}980236} = 0{,}00000085 +$ to be added to 6,240083: Or $\frac{0{,}000002}{12{,}980248} = 0{,}00000015 +$ to be abated of 6,240084: (Or it may ſuffice in either, to divide by 12,98 +, or even by 13 —, without being incumbred with a long Diviſor (either of which gives us, for the Root ſought, 2,08008385 *proxime*. True (at the third Step) to the eighth Place of Decimal Parts. And if this be not near enough, the Cube of this compared with the Number propoſed, will give us another b for the next Step, and ſo onwards as far as we pleaſe.

Now what is ſaid of the Cube, is eaſily applicable to the higher Powers.

That of the Biquadrate may be omitted, becauſe here perhaps it may be thought moſt adviſable to extract the Square Root of the Number propoſed; and then the Square Root of that Root.

But if we would do it at once, we are from n (the Number propoſed, being not a Biquadrate) to ſubtract a^4 (the greateſt Biquadrate contained in it) to find the Remainder $b = 4a^3e + 6a^2e^2 + 4ae^3 + e^4$, which Remainder, if we divide by $4a^3$, the Quotient will certainly be too big for e, though perhaps not much.

If by $4a^3 + 6a^2 + 4a + 1$, it will certainly be too little, for Reaſons before mentioned. And we are to uſe ~~our~~ Diſcretion in taking ſome intermediate Number. And if we thence chance not to hit on the neareſt, the Inconvenience will be but this, that our Leap will not be ſo great as otherwiſe it might be, which will be rectified by another b at the next Step.

For the *Surſolid* (of the five Dimenſions) we are from n (the Number propoſed, being not a perfect *Surſolid*) to ſubtract a^5 (the greateſt *Surſolid* therein contained) to find the Remainder.

$b = 5a$

$$b = 5a^4e + 10a^3e^2 + 10a^2e^3 + 5ae^4 + e^5.$$

which (as before) if we divide by $5a^4$, the Reſult will be ſomewhat too big, becauſe the Diviſor is too little.

If by $5a^4 + 10a^3 + 10a^2 + 5a + 1$, the Reſult will certainly be leſs than the true e. The juſt Value of e being ſomewhat between theſe two, where we are to uſe our Diſcretion, what intermediate Number to take; which according as it proves too great or too little, is to be rectified at the next Step.

If to direct us in the Choice of ſuch intermediate Numbers, we ſhould multiply Rules of Precepts for ſuch Choice, the Trouble of obſerving them would be more than the Advantage to be gained by it. And for the moſt Part it would be ſafe enough, and leaſt Trouble, to divide by $5a^4$, which gives a Quotient ſomewhat too big; which we may either rectify at Diſcretion, by taking a Number ſomewhat leſs, or proceed to another b (affirmative or negative as the Caſe ſhall require,) and ſo onward to what Exactneſs we pleaſe, which is, for Subſtance, in a Manner coincident with Mr. *Raphſon*'s Method, even for affected Equations.

Thus, in the preſent Caſe; if the Number propoſed be $n = 33$, then is $a^5 = 32$, and $b = 33 - 32 = 1 = 5a^4e + 10a3\,e^2 + 10a^2e3 + 5ae^4 + e^5$, which if we divide by $5^{a4} = 5 \times 16 = 80$, the Reſult $\frac{1}{80} = 0{,}0125$ is ſomewhat too big for e, but not much. And if we examine it, by taking the *Surſolid* of 2,0125, or of $2\frac{1}{80}$, we ſhall find a Negative b (for the next Step) but not very conſiderable. Or if we think it conſiderable, we may proceed further to another Step, or more than ſo.

The like Method may be applied, with more Advantage, in the higher Powers, according as the Compoſition of each Power requires. And the ſame Method may be of Uſe, with good Advantage, in long Numbers, if duly applied, even before we come to the Place of Units, for the ſame will equally hold there alſo.

APPURTENANCES, [in the *Common Law*,] are the ſame with *Appendants*; which ſee.

APSIS, [Ἀψὶς, *Gr. a Vault or Arch*,] in *Aſtronomy*, is uſed as well for the higheſt Part of an Orbit, to which when a Planet comes, it is at the greateſt Diſtance from the Earth, and is called the *Apogæum*; as the loweſt Part of that Orbit, when the Planet is in its neareſt Diſtance to the Earth, which is called the *Perigæum* of that Planet.

APSYCHY, [Αψυχία] of *α Priv.* and Ψυχὴ, *Gr. the Soul*, &c.] a Swooning or Fainting away.

To APTATE *a Planet*, [in *Aſtrology*,] is to ſtrengthen the Planet in Poſſeſſion of Houſe and Dignity, to the greateſt Advantage, in order to bring about the deſired End.

APTITUDE, is the natural Diſpoſition that any thing hath to be fitting for ſuch or ſuch a Purpoſe. Thus Oil hath an Aptitude to burn; and Water to extinguiſh Fire.

APTOTE, [of *α* and πτῶσις, *Gr. a Caſe*,] in *Grammar*, is a Noun indeclinable, or which is without the Variation of Caſe.

APYREXY, [Ἀπυρεξία, *Gr.*] is an Intermiſſion, cooling or abating of a Fever; the Cauſe of it is, that all the morbifick Matter is ſpent in one Fit, and ſo it intermits till new come, and begins to ſwell and ferments as the other. *Blanchard.*

AQUA *omnium Florum*, [in *Medicine*,) *i. e.* a Water of all Flowers; the Water diſtilled from the Dung of Cows when they go to Graſs.

AQUA *Pericardii*, (in *Medicine*,) that Liquor or Humour that is collected about the Heart, ſerving to cool it. *L.*

AQUA *Regia*, i. e. *Royal Water*; a Liquor made by diſſolving *Sal Armoniack* in Spirit of *Nitre*, ſo called becauſe it diſſolves Gold.

AQUA *Secunda*, a Liquor made of common Water, and the Powder or Precipitate of Silver; it is uſed to cauſe an Eſcar to fall off in Shankers, and to conſume proud Fleſh.

AQUÆDUCT, is the Term in Architecture for a Conduit or Work to convey Water, without Force of Engines, to any Place.

AQUÆDUCTUS, (in *Anatomy*,) is the Bony Paſſage of the *Tympanum* of the Ear, reaching into the Palate of the Mouth.

AQUA FORTIS, is made by diſtilling in a cloſe Reverberatory Furnace a Mixture of equal Parts of *Purified Nitre*, *Vitriol calcined white*, and *Potter's* Earth or Clay dried and powdered. A ſmall Fire is uſed at firſt to warm the *Retort*, and to draw off the *Phlegm*; but as ſoon as the Spirits begin to appear in the Receiver in red Clouds, the Fire is raiſed to the moſt intenſe Degree, and kept ſo till white Fumes begin to come forth; then unlute the Veſſels, and you have the *Aqua Fortis* in the Receiver. 'Tis uſed to diſſolve Metals.

AQUALICULUS, the lower Part of the Belly, being the ſame with *Hypogaſtrium.*

AQUARIUS, (in *Aſtronomy*,) the eleventh Sign in the *Zodiack*, reckoning from *Aries*: See *Conſtellation.*

The Sun moves through it in the Month of *January*; 'tis marked thus ♒. See *Character.*

The Poets feign that it was *Ganymede*, whom *Jupiter* raviſhed under the Shape of an Eagle, and carried away into Heaven, to ſerve as Cupbearer in the room of *Hebe* and *Vulcan*; whence the Name. Others hold, that the Sign was thus called, becauſe when it appears in the Horizon, the Weather uſually proves rainy. The Stars in the Conſtellation *Aquarius*, in *Ptolemy*'s Catalogue are 45; in *Tycho*'s 40; in the *Britannick* Catalogue 99.

AQUATICK, or *Aquatile*, is that which belongs to, or lives moſtly in the Water: Thus thoſe Animals or Plants that live or grow uſually in Water, are called *Aquatick Animals* and *Plants.*

AQUEOUS *Ducts*, (*Anatomy*,) certain Ducts whereby the aqueous Humour is ſuppoſed to be convey'd into the Inſide of the Membranes, which incloſe that Liquor.

AQUEOUS *Humour*, or the watry Humour of the Eye, is the utmoſt, being tranſparent, and of no Colour; it fills up the Space which lies between the *Cornea* Tunicle and the Chryſtalline Humour.

AQUILA, (in *Aſtronomy*,) a Conſtellation in the *Northern* Hemiſphere, uſually joined with *Antinous*: See *Conſtellation.*

The Stars in the *Conſtellation Aquila* and *Antinous*, in *Ptolemy*'s Catalogue are 15; in *Tycho*'s 17; in the *Britannick* Catalogue 70.

AQUILA *Alba*, or the *White Eagle*, the ſame with *Mercurius Dulcis*; which ſee.

AQUOSI *Ductus*, (*Anatomy*,) the watery Paſſages, the Channels of the Veins that carry watery Humours called *Lympha.*

AQUULA, a ſmall watery Bladder in the Liver, Spleen, or any other Bowel.

ARA, *the Altar*, a Southern Conſtellation, conſiſting of eight Stars.

ARACNOIDES, [Ἀραχνοειδὴς, of ἀράχνη, *a Spider*, and εἶδος, *Form*, *Gr.*] is the *Chryſtalline Tunick* of the Eye; by ſome called alſo,

ARANEA *Tunica*, or *Chryſtallina*; and is that which ſurrounds and contains the *Chryſtalline Humour*; by reaſon of its light thin Contexture, like that of the Web of a *Spider*; it has the Name of *Aranea*. This Coat, by Means of the *Ciliary Proceſſes*, helps to move the Chryſtalline Humour of the Eye nearer to, or farther from the *Retina*, and perhaps alſo to render its Figure more or leſs convex.

ARÆOSTYLE, [of Ἀραιὸς *thin*, and ϛύλος, *Gr. a Column*,] in *Architecture*, is a ſort of Edifice where the Pillars are ſet at a great Diſtance one from another.

ARBITRATOR, is an extraordinary Judge in one or more Cauſes between Party and Party, choſen by their mutual Conſents. The *Civilians* diſtinguiſh between *Arbiter*, who is to proceed and judge according to Law and Equity mingled, and *Arbitrator*, who is permitted wholly to uſe his own Diſcretion, without Solemnity of Proceſs, or Courſe of Judgment, to hear and determine the Controverſy committed unto him.

ARBITREMENT, is a Power given by two or more contending Parties, to ſome Perſon or Perſons, to determine the Matter in Diſpute between them, and to pronounce the ſame, to which they bind themſelves under a Penalty to ſtand; and the Determination thus made is called an *Award*, or the Reſult of an Arbitration.

ARBOR *Dianæ*: See *Diana*'s *Tree*.

ARBOR *Martis*, is a Name by ſome Chymiſts given unto *Coral*, becauſe it grows like a Tree or Plant under the Water in the Sea.

ARBOR, [in *Mechanicks*,] the principal Part of a Machine which ſerves to ſuſtain the reſt; alſo a Spindle or Axis on which a Machine turns.

ARBOREOUS, is by the *Botaniſts* uſed for ſuch *Fungi* or *Muſci* which grow upon Trees, whereas others grow on the Ground. Thus *Agarick* is a *Fungus arboreus*, becauſe it always grows on the *Laryx*. But the *Fungus pulverulentus* is *terreſtrial*, always growing on the Ground.

ARBORIST, is one that hath good Skill in the ſeveral Kinds and Natures of Trees; and knows how to propagate and preſerve them well for their ſeveral Uſes.

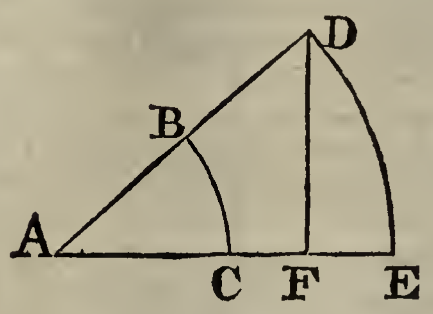
ARCANUM *Coralinum*, is the *Red Precipitate* of Mercury, on which hath been burnt ſix times well rectify'd Spirit of Wine, in order to burn off ſome of the Acids, and to ſweeten the *Precipitate* ſo as that is may be fit to be taken inwardly.

ARCANUM *Duplum*, is a Kind of Salt gained by waſhing the *Caput Mortuum* remaining after the Diſtillation of double *Aqua Fortis* with warm Water; which Water is afterwards filtrated and evaporated, and the Salt remains at the Bottom of the Glaſs.

ARCANUM *Jovis*, is an *Amalgama* made of equal Parts of Tin and Mercury, powder'd and digeſted with good Spirit of Nitre; and from it the Spirit being drawn in a Retort, the dry Maſs is powdered again, and then digeſted with Spirit of Wine till the Powder be inſipid.

ARC's *Similar*. If the *Arc B C* does contain the ſame Number of Degrees as the *Arc D E*; or if the *Radius A B* is to the *Radius A D*, as the *Arc B C* is to the *Arc D E*, then the *Arcs B C* and *D E* are *ſimilar*.

If the *Radius A D* of any *Arch D E* be ſuppoſed 1, and the *Sine D F* thereof be called *y*, then



the Length of the *Arc D E* will be expreſs'd by this infinite Series:

$$y + \frac{1}{2\times3}y^3 + \frac{1\times2}{2\times4\times5}y^5 + \frac{1\times3\times5}{2\times4\times6\times7}y^7 + \frac{1\times3\times5\times7}{2\times4\times6\times8\times9}y^9, \text{ \&c.}$$

And if the firſt Term of this Series be called *A*, the ſecond *B*, the third *C*, the fourth *D*, &c. and the ſecond be multiplied by $\frac{1}{1}$, the third by $\frac{3}{3}$, the fourth by $\frac{5}{5}$, *&c.* then the foregoing Series will be changed into this:

$$y + \frac{1}{2\times3} + Ay^2 + \frac{3}{4\times5} + 3By^2 + \frac{5}{6\times7} + 5Cy^2 + \frac{7}{8\times9} + 7Dy^2 + \frac{9}{10\times11}\text{ \&c.}$$

The Diſtance of the Centre of Gravity of an Arc of a Circle from the Centre of the Circle, is a third Proportional to a third Part of the Periphery and the Radius.

ARCH [of *Arcus*, *L. a Bow*,] a Bending in Form of a bent Bow.

ARCH, } [in *Geomery*,] is any Part of the Cir-
ARK, } cumference of a Circle or curved Line lying from one Point to another, by which the Quantity of the whole Circle, or Line, or ſome other thing ſought after may be gathered.

ARCH, } [in *Aſtronomy*,] as *the Diurnal Arch*
ARK, } *of the Sun*, is Part of a Circle parallel to the Equator, which is deſcribed by the Sun in his Courſe between Riſing and Setting.

ARCH *of Progreſſion*, } [*Aſtron.*] is an Arch of
ARCH *of Direction*, } the *Zodiack* which a Planet ſeems to paſs over, when the Motion of it is according to the Order of the Signs.

ARCH of *Retrogradation*, [*Aſtron.*] is an Arch of the *Zodiack* deſcrib'd, while a Planet is retrograde, moving contrary to the Order of the Signs.

ARCH *of Viſion*, (*Aſtron.*) is the Depth of the Sun below the Horizon, at which a Star begins to riſe again, which before was hid in his Rays.

ARCHÆUS, [of Ἀρχὴ, *Gr.*] with the *Paracelſians*, is the Principle of Life, Health, and Vigour, in any animal Body.

ARCHAISMS, [of Ἀρχαισμοὶ, *Gr.*] are obſolete Expreſſions now out of Uſe, and to be found only in ancient Authors.

ARCH-DEACON, being only a Perſon choſe out of thoſe Deacons which were originally the Attendants on, and Servants to the Biſhop in Spiritual Affairs, at firſt was a Perſon employed by the Biſhop in more ſervile Uſes, and he always was in Subſervience to the *Urbans*, or Rural Deans of Chriſtianity, to whom Arch-Deacons were as much inferior, as their Order of Deacon was to that of Prieſt; till by the Advantages of a perſonal Attendance on the Biſhop, and a Delegation to examine and report ſome Cauſes, and a Commiſſion to viſit ſome remoter Parts of a Dioceſe, their Power and Dignity was advanced above the Arch-Presbyter or *Dean*. Dr. *Kennet*'s Gloſſary. 'Tis now allow'd, that Arch-Deacons have a Power, not only to viſit, but to ſuſpend, excommunicate, and in many Places to prove Wills, and in ſome to inſtitute to Benefices. 'Tis one Part of the Arch-Deacon's Office to induct all Clerks into their Benefices within his Juriſdiction; and by the Act of Uniformity he is now obliged to be in Prieſt's Orders.

Similar ARCHES, [in *Geometry*, are ſuch as contain the ſame Number of Degrees of unequal Circles.

Semicircular ARCHES, [in *Architecture*,] are thoſe which make an exact Semi-circle, and have their Centre in the Middle of the Chord of the Arch.

Scheme ARCHES, [*Architecture*,] Arches that are leſs than a Semi-circle, and of Conſequence are flatter, containing 90, 70, or 60 Degrees.

ARCHES *of the third and fourth Point*, [*Architecture*,] are ſuch as conſiſt of two Arches of a Circle ending in an Angle at the Top, and are drawn from the Diviſion of a Chord into three or four Parts at Pleaſure.

Elliptical ARCHES, [*Architecture*,] conſiſt of a *Semi-Ellipſis*, and have commonly a Key-ſtone, and Chaptrels or Impoſts; they were formerly much in Uſe for Mantle-pieces in Chimneys.

ARCHES *Strait*, as the Workmen improperly call them, which are uſed over Doors and Windows, &c. have plain ſtrait Edges both upper and under, which are parallel, but both the Ends and Joints do all point towards a certain Centre; they are uſually now about a Brick and a half thick; which, when rubb'd, is about twelve Inches. The levelling End of this Arch is called the *Skew-back*, and the ſeveral Joints between the Courſes of Bricks in the Arch, the Workmen call the *Sommering*.

ARCHES, (or the Court of the *Arches*) is the chief and moſt ancient Conſiſtory belonging to the Archbiſhop of *Canterbury*; and it is ſo called from the Arches of the Church where the Court is kept, namely, *Bow-Church* in *London*.

ARCHES, the Judge of the Court of the Arches is called the Dean of the Arches, or the Official of the Arches Court, &c. With this Officialty is commonly joined a peculiar Juriſdiction of thirteen Pariſhes in *London*, term'd a Deanery, and exempt from the Authority of the Biſhop of *London*, and belonging to the Archbiſhop of *Canterbury*: Of which the Pariſh of *Bow* is one, and the Principal, becauſe the Court is kept there. Others think he was firſt called the Dean of the *Arches*, becauſe the Official to the Archbiſhop being many times employed abroad in Embaſſies for the King and Realm, the *Dean of the Arches* was his Subſtitute in this Court, and by that Means the Names became confounded. The Juriſdiction of this Judge is ordinary, and extendeth it ſelf through the whole Province of *Canterbury*, ſo that on any Appeal made, he forthwith, and without any farther Examination of the Cauſe, ſends out his Citation to the Appellee, and his Inhibition to the Judge from whom the Appeal was made. *Vid. Hiſtor de Antic. Eccl. Britan.* and 4. Part of *Inſtit. Fol.* 337, &c.

ARCHETYPAL *World*, [with the *Platoniſts*,] the World as it exiſted in the Divine Mind, or in the Idea of God before the *Creation*.

ARCHEUS, ['Αρχὴ, *Gr. Beginning*,] the higheſt and moſt exalted Spirit that can be ſeparated chymically from mixed Bodies.

ARCHIGENII *Morbi*, acute Diſeaſes. *L.*

ARCHIPELAGUS, [of *ἀρχὸς chief*, and ϖέλαγος, *Gr. the Sea*,] in *Geography*, is a Part of the Sea containing many ſmall Iſlands one near another, and conſequently ſeveral little Seas denominated from thoſe Iſlands; as the *Græcian Archipelago*, or *Ægean Sea*.

ARCHITECTONICK, [Αρχιτεκτονικὴ, *Gr.*] is that which builds a thing up regularly according to the Nature and Properties of it. Thus that plaſtick Nature, Power, Spirit, or whatever it be called, which hatches the *Ova* of Females into living Creatures of the ſame Species, is by ſome called the *Architectonick Spirit*.

ARCHITECTURE, [Ἀρχιτεκτονικὴ, *Gr.*] the Art of Building, *i. e.* of erecting Edifices, proper either for Habitation or Defence. *Architecture* is ſcarce inferior in Antiquity to any Art, though, like others, very rude and ſimple in its firſt Beginnings; for Neceſſity put the Inhabitants of the Earth to build them Tents, Huts, and Cottages, to defend them from the Injuries of the Weather, which in Courſe of Time gradually grew to more regular Habitations, and from them to more ſtately and magnificent ones, being adorned with Variety of Ornaments.

Some ancient Writers attribute the firſt Uſe of Architecture to the *Tyrians*, who, as they ſuppoſe, taught it to *Solomon* and his Workmen: Others ſay, that the *Tyrians* were only Under-workmen to *Solomon*, and learnt the Art from him, which they afterwards communicated to the *Egyptians*, and they to the *Grecians*, from whom it ſhould ſeem the *Romans* borrowed it, in that moſt of the Parts, even Members, Mouldings, &c. come to us with a *Greek* Name; and three Orders, *Corinthian*, *Dorick*, and *Ionick*, are wholly of a *Grecian* Original.

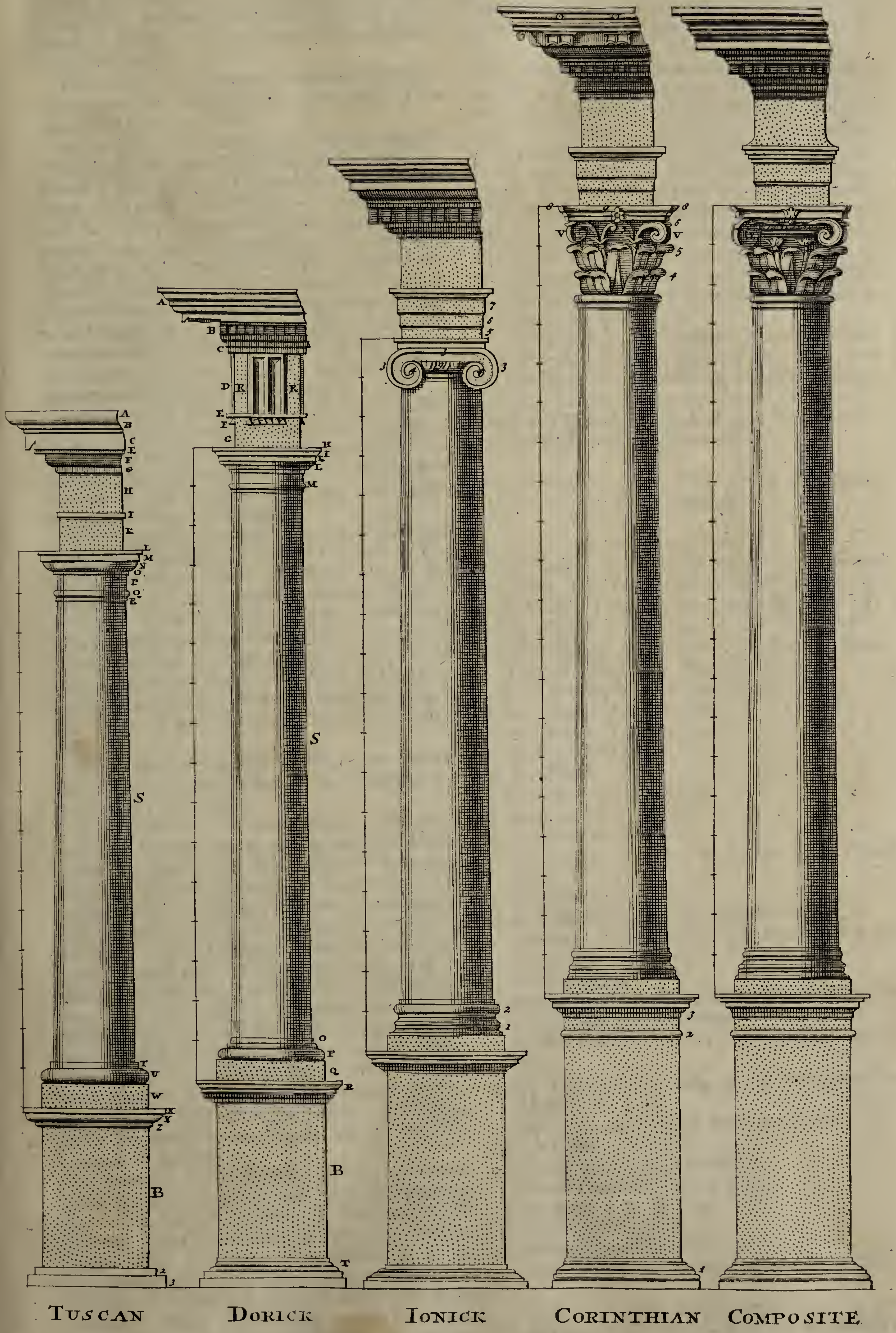
The *Romans* ſeem to be unacquainted with any Order but the *Tuſcan*, and to have had little or no Notion of the Grandeur and Beauty of Building, but what proceeded from their Magnitude and Strength.

Architecture arriv'd at its Glory among the *Romans* in the Time of *Auguſtus*, but his Succeſſor *Tiberius* neglected it; *Nero* indeed had an Inclination for Building, but Luxury and Diſſoluteneſs were more viſible in his Structures than true Magnificence. In *Trajan*'s Time the excellent Architect *Apollodorus* flouriſhed, and the Art too a little; but afterwards began to dwindle; and though it was ſupported for ſome Time by the Care and Magnificence of *Alexander Severus*, yet it fell totally to Ruin and Oblivion with the *Weſtern Empire*. The Ravages of the *Viſgoths* in the 5th *Century*, deſtroyed almoſt all the beautiful Monuments of Antiquity, conſiſting of Groteſque Ornaments; after which *Architecture* became ſo coarſe and artleſs, that the greateſt Architects knew nothing of juſt Deſigning; and from this State it was not recover'd for the Space of 12 *Centuries*.

Charlemain labour'd ſtrenuouſly to reſtore *Architecture*, and the *French* made very ſucceſsful Pro-

greſs

Place this under the Word Architecture



greſs in it under *Hugh Capet*. His Son *Robert* proſecuted the Deſign of his Father, and by Degrees the modern *Architecture* was run into as great an Exceſs of Delicacy, as the *Gothick* had done before in Maſſiveneſs.

The *Arabick* and *Mooriſh* Architecture, borrowed from the *Moors* and *Saracens*, were much of the ſame Kind with the *Gothick*.

In the 13th, 14th, and 15th *Centuries*, the Architects who had ſome Knowledge in *Sculpture*, beſtowed a Multitude of Ornaments on their Buildings, with great Care, though without true Conduct or Taſte, and ſeem'd to imagine, that Perfection in *Architecture* conſiſted in Delicacy and a Multiplicity of Ornaments. The *Italian* and *French* Architects bent their Studies for the two laſt *Centuries* wholly upon retrieving the primitive Beauty and Simplicity of the ancient *Architecture*, and have ſucceeded happily; and we in *England* have ſo reformed, that our Churches and publick Edifices are now built after the *Antique*.

Architecture is uſually divided into *Civil* and *Military*; *Civil Architecture* teaches how to make any Kinds of Buildings, Palaces, Churches, or private Houſes. *Military Architecture* inſtructs us in the beſt Way to fortify Cities, Camps, Sea-ports, or any other Places of Strength.

The Ancients, at ſeveral Times, and on ſeveral Occaſions, eſtabliſhed Five *Orders* of *Architecture*, that is, five ſorts of Pillars, *viz.* the *Tuſcan*, the *Dorick*, the *Ionick*, the *Corinthian*, and the *Compoſite*, or *Roman Order*, (*which ſee under thoſe Words,*) The Difference between which *Orders* conſiſts in the *Column*, with its *Baſe* and *Capital*, and the *Entablature*, that is, the *Architrave*, *Frije*, and *Cornice*; for theſe are the Parts which conſtitute the *Order*, and each one hath its proper and peculiar Meaſures.

Beſides theſe five ancient Orders, ſome Authors mention two more, as that of the *Caryatides* and the *Perſick*; which ſee.

The Rules of *Architecture* require, That in a well-built Fabrick there ſhould be *Solidity*, *Convenience* and *Beauty*; to which ſome Writers add, *Order*, *Diſpoſition*, *Proportion*, *Decorum*, and *Oeconomy*: And theſe Eight, they ſay, make the neceſſary Parts of *Architecture*. *Solidity* implies the Choice of a good Foundation, and good ſound Materials to work with. *Convenience* conſiſts in ſo ordering and diſpoſing the Parts of an Edifice, that they may not hinder or embarraſs one another. *Beauty* is that agreeable Form and pleaſing Appearance which it exhibits to the Eye of the Spectator. *Order*, they ſay, gives each Part of the Building a convenient Bigneſs, whether we conſider them apart, or with Relation to the whole. And *Diſpoſition* they make the due ranging and agreeable Union of all the Parts.

Proportion, is the Relation that all the Work hath to its Parts, and which every one ſeparately hath to the Idea of the whole: For among Works that are perfect, from any particular Part we may make certain Judgment of the Greatneſs of the whole Work; *v. gr. the Diameter of a Pillar*, or the Length of a *Triglyph*, gives us a right Idea of the whole to which they belong. And to expreſs the Relation that many things have to one another, as to their Greatneſs, and the different Number of their Parts, *Vitruvius* indifferently uſes thoſe three Words, *Proportion*, *Eurithmy*, and *Symmetry*; the two laſt of which are much of the ſame Senſe with the firſt.

Decorum or *Decency* comes next to be conſidered, which conſiſts in making the whole Aſpect of the Fabrick ſo correct, that nothing ſhall appear but what is founded upon, and approved by ſome Authority: And they ſay, *Decorum* teaches you to have a Regard to theſe three things, *Deſign*, *Cuſtom*, and *Nature*. The Regard to *Deſign* makes us chuſe, for Inſtance, other Diſpoſitions and Proportions for a Palace than a Church. The Reſpect we pay to *Cuſtom*, makes us adorn the Porches and Entries into ſuch Houſes as are within rich and magnificent. And the Regard we have to the Nature of the Places, makes us pitch upon different Proſpects for different Parts of a Building: As for Example, we expoſe Bed-chambers and Libraries to the Morning Sun: Winter Apartments to the *Weſt*, and Cloſets of Pictures, *&c.* to the *North*, becauſe they require an equal Light.

Oeconomy teaches the Architect, they ſay, to have Regard to the Expences that are to be made, and the Quality of the Materials near the Places where he builds, and to take his Meaſures rightly for the Order and Diſpoſition, *viz.* to give the Fabrick a convenient Form and Magnitude.

The Explanation of the Plate for the Five Orders of Architecture.

In the Tuſcan *Column.*

a the *Ovolo* or *Egg*: In the *Ionick* and *Corinthian* Orders, and every where by ſome 'tis called the *Echinus*. The *French* call it the *Quart de rond*.
b the *Aſtragal* or *Baguette*, as the *French* call it: The *Italians* the *Tondino* or *Round*; below which is a ſmall Liſt, Reglet or Fillet.
c is the *Crown*, the *French* call it the *Larmier*.
e the Liſt or Fillet under that.
f the *Gula*, or *Talon* in *French*.
g the Liſt of the *Gula*.
H the *Frieze*.
i the Liſt of the Architrave.
k the Architrave.
l the Liſt of the *Abacus*.
m the *Abacus Cymatium*, or *Saillon*, as the *French* call it.
n the *Ovolo* or *Echinus*.
o the Liſt, Fillet, or Ring under that.
p the Frieze of the Capital; the *French* call it the *Gorgerin* or *Collarin*.
q the Aſtragal of
r the *Conge* or *Ceincture*, as the *French* call it; or of the Neck of the Column.
s the Body of the Column; in *French* the *Fuſt* or *Vif*.
t the Liſtel of the Baſe, or the Netherband or Swath.
u the Tore, or the *Groſs Baton* in *French*.
w the Plinth.
x The Reglet, Liſt, or Fillet.
y the *Gula* reverſed, or the *Talon*.
z the Ring, Liſt, or Fillet.
B the Die of the Baſe.
2 the Reglet or Fillet.
3 The Baſe of the Pedeſtal, in *French* the *Zocle*.

In the Dorick *Column.*

a the *Gula*, ſometimes the Grove or hollowing of the upper Liſt.
b the Dentils or Teeth.
c the Capital of the Triglyph.
d the Triglyph, of which thoſe Parts that are fra-

med inwards or hollowed are called Flutes ; and the Square of the Frieze between the Triglyph is called the Metops ; as *r* ; and ſometimes the outermoſt towards the Right-hand is called a Demi-Metops.

e the *Cymatium* or *Bandelette.*
f the *Guttæ* or Drops.
g the Platband or Face.
h the Reglet.
i the *Talon* or *Gula.*
k the *Ovolo* or *Echinus.*
l three Annulets or Fillets.
m the Frieze, Gorgerin or Collarin.
S the Fuſt, Shaft or Body of the Pillar,
o the Liſtel.
p the Tore.
q the Plinth.
r the Fillets and *Gula.*
B the Die of the Baſe.
t the Fillets or Reglets of
u the Baſe of the Pedeſtal.

In the Ionick *Column, the Things in which it differs from the former, are theſe.*

1. the firſt *Scotia.*
2. the ſecond *Scotia.*
3. The Bands or Canal of the *Volutæ.*
4. the *Volutæ.*
5. the firſt or little Face.
6. the ſecond or middle Face.
7. the third or the great Face.
9. the Figure of *Eggs* carved there.

In the Corinthian *Column, the Things peculiar are,*

1. A Tore, Reglet, and *Gula*, finely wrought.
2. a Reglet and Aſtragal, with
3. Frieze about it.
4, 5, 6. the Ranks or Rows of Leaves, ſome ſay of the *Acanthus*, or Great Dock, others of Olive, and others of Palm.
8. the *Abacus* of the Capital.
9. the Flower.

In the Compoſite *Order.*

The Pedeſtal of this Column is the ſame with that of the *Corinthian*, except in the Members of the *Cymatium* and *Baſe.*

And the *Compoſite* Capital differs from the *Corinthian* only in this ; that it hath *Volutæ* or Scrolls like the *Ionick*, when the *Corinthian* hath curled Stalks ; and therefore 'tis called *Compoſite*, becauſe 'tis compoſed of the *Ionick* and *Corinthian* together.

ARCHITECTURE. Some Writers on this Subject.

Vitruvius in *Latin. Amſterdam.* 1649. *Fol.*

In *Engliſh*, by Mr. *Chr. Waſe.*

In *French*, by Mr. *Claude Perrault. Paris.* 1673. *Fol.*

Courſe d'Architecture enſeigni dans l'Accademie Royal d'Architecture. Par Monſ. Fran. Blondell, a Paris. 1675. *Fol.*

Mr. *Evelyn*'s Parallel of Architecture, laſt Edit. 1706. *Lond. Fol.*

Adami Boecleri Architectura curioſa nova cum multis Figuris. Norimberg.

Albert Dureri, Architectura & Geometria. Paris. 1535.

Potſi's Architecture, in 2 Vol. Fol. in *Latin* and *Italian*, and lately done into *Engliſh.*

L'Architecture, par Jacques Androuet du Cerceau. Paris. 1615.

L'Architectura d' Andria Palladio. Venet. 1642. *con Fig.* This is tranſlated into *Engliſh.*

Vitruvius and *Vignola*, abridged by Mr. *Perrault.*

Palladio's, } Architecture.
Scamozzi's }
Wotton's }

Naval ARCHITECTURE, an Art that teaches the Conſtruction of Ships, Galleys, and other floating Veſſels for the Water, with Ports, Moles, Docks, &c. on the Shore, for the Reception of Shipping. &c.

Counterfeit ARCHITECTURE, is that wherein the Projectures are painted, either with black or white, or coloured, after the Manner of Marble ; which is alſo called *Scene Work* in the painting of *Columns*, &c. which ſeem to ſtand out *in Relievo* in Theatres.

ARCHITECTURE, [in *Perſpective*,] a Sort of Building, the Members of which are of different Meaſures and Modules, and diminiſh in Proportion to their Diſtance, to make the Building appear longer and larger to the View than it really is.

ARCHITRAVE, is the principal Beam or Poitrail in any Building, and the firſt Member of the Entablement, being that which bears upon the Column, and is made ſometimes of a ſingle Summer, as appears in moſt of the ancient Buildings, and ſometimes of ſeveral Haunſes, as is uſual in modern Buildings. It is called the *Reaſon-piece*, or *Maſter-beam*, in Timber Buildings, but in Chimneys it is called the *Mantle-piece* ; and over the Jaumbs of Doors, and Lintels of Windows, *Hyperthyron.*

ARCHITRAVE, [in *Building*,] is that Part of a Column, or Order of Column which lies immediately upon the Capital, and is the loweſt Member of the Frieze, and even of the whole Entablature.

The *Architrave* is ſuppoſed to repreſent the principal Beam in Timber Buildings ; whence the Name which is form'd of the *Greek* 'Αρχη *chief*, and the *Latin Trabs*, Beams.

The *Architrave* is different in the different Orders. In the *Tuſcan* it only conſiſts of a Plain, crown'd with a Fillet, and is half a Module in Height.

In the *Dorick* and *Compoſite*, it has two Faces or *Faciæ* ; and three in the *Ionick* and *Compoſite* ; in which laſt Order it is $\frac{10}{12}$ of a Module in Height, though but half a Module in the reſt.

ARCHITRAVE *Doors*, ſuch as have an Architrave in the Jaumbs and over the Door, upon the Cup-piece if ſtrait, or on the Arch if the Top be curved.

ARCHITRAVE *Windows* are commonly an *Ogee* raiſed out of the ſolid Timber with a Liſt over it.

ARCHIVAULT, [in *Architecture*,] the inner Contour of an Arch, or a Band or Frame adorned with Mouldings, running over the Faces of the Arch-ſtones, and bearing upon the Impoſts. It is different in the different Orders. In the *Tuſcan* it has only a ſingle Face ; two Faces crown'd in the *Dorick* and *Ionick* ; and the ſame Mouldings with the Architrave in the *Corinthian* and *Compoſite.*

The Word is *French*, *Archivolte*, where it ſignifies the ſame thing.

ARCTICK *Circle*, is a leſſer Circle of the Sphere drawn on the Globe parallel to the Equator, and at 20°. 30′. diſtant from the North Pole of the World, from whence it takes its Name.

This, and its Oppoſite the *Antarctick*, are called the *two Polar Circles.* They may be conceived to be deſcribed by the Motion of the Poles of the Ecliptick round the Poles of the Equator, or of the World.

ARCTOPHYLAX: See *Bootes.*

ARCTOS *Minor*, the ſame with *Urſa Minor.*

ARCTURUS, a fixed Star of the firſt Magnitude placed in the Skirt of *Arctophylax*: Its Longitude is 199°. 39′. Latitude 31°. 2′. Right Aſcenſion 210°. 13′. and Declination 20°. 58′.

ARCUALIA *Oſſa*, [*Anatomy*,] the Bones of the *Sinciput*, or, as ſome will have it, of the *Temples. L.*

ARDENT *Spirits*, [in *Chymiſtry*,] are ſuch Spirits as being diſtilled from fermented Vegetables, will take Fire and burn, as Spirit of Wine, Brandy, *Aquavitæ*, *&c.* They are uſually diſtilled in an Alembick, or in a Copper Body with its Moor's Head and Refrigeratory.

ARDOR *Ventriculi*, is the Diſeaſe commonly called the *Heart-burn.*

ARDOR *Urinæ*, is the ſame with *Dyſuria.*

AREA *of any Figure*, (in *Geometry*,) is its internal Capacity or ſuperficial Content reckoned in the ſquare Parts of any Meaſure; as if a Field be in the Form of a Square, and its Side be forty Yards in Length, its *Area* or ſuperficial Content will be 1600 ſquare Yards: Or will contain 1600 little Squares, each of which is a Yard every Way.

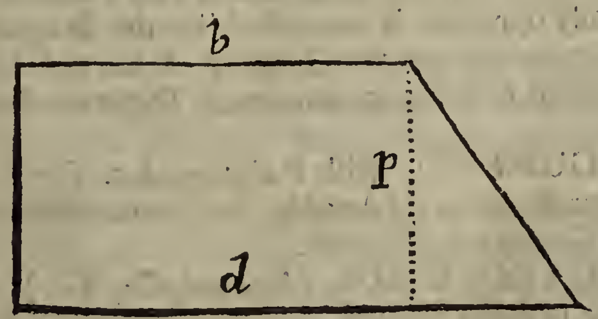
Problems. To find the Area *of all Sorts of Plane Figures.*

1. For a *Square* or *Rectangle*, multiply one Side found in any known Meaſure by another: The Product is the true *Area.* The Reaſon of which you have under *Multiplication* in *Geometry*; which ſee.

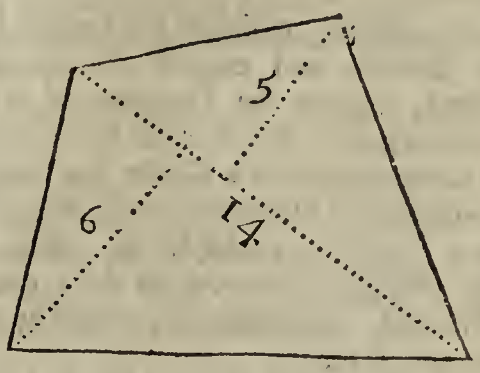
2. *For all Parallelograms*, multiply the Perpendicular let fall from any Side, by the Side it falls upon; and the Product is the *Area.* Becauſe all ſuch Figures are equal to Rectangles of the ſame or equal Baſe and Altitude.

3. *For all Plane Triangles*, multiply half the Perpendicular let fall from an Angle, by the oppoſite Side, or half that Side by the Perpendicular, and the Product is the true *Area*; becauſe Triangles are the Halves of Parallelograms of the ſame or equal Baſes and Altitudes.

4. *For a Trapezium, where two Sides are parallel*, multiply the Sum of the parallel Sides (*b* and *d*) by half (*p*) the Perpendicular.



5. *For any other Trapezium, or any Multangular Plane Figure*, reſolve it diagonally into Triangles; and add the *Area's* of thoſe Triangles (found by the third *Problem*) into one Sum; which will be the true *Area* of the whole. Thus, ſuppoſe a *Trapezium* whoſe Sides are not parallel, divide it into two Triangles by a Diagonal, and let fall a Perpendicular from the other Angles thereto; then multiply the whole Baſe by half the Sum (or half the Baſe by the whole Sum) of the Perpendiculars, the Product is the *Area.*



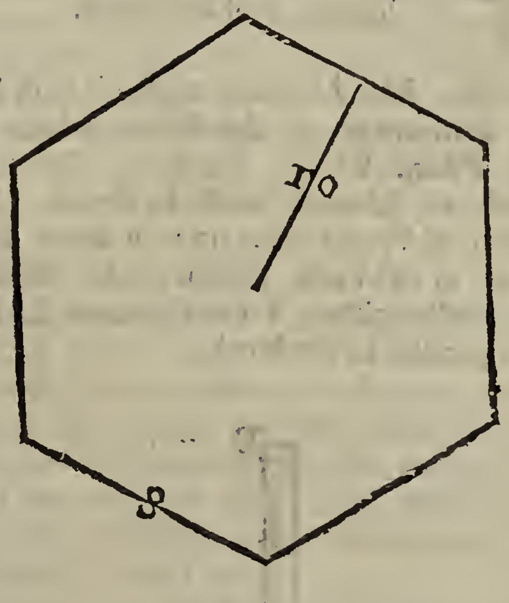
Baſe 14, its Half 7
Sum of the Perpen. 11, its Half 5,5.

14	11	
5,5	7	
70	77	*Area* 77.
70		
77		

6. *For all regular Figures, or Polygons*, multiply the half Sum of all the Sides by the Length of a Line drawn from the Centre to the Middle of any one Side, the Product gives the *Area.*

Becauſe that Line will be equal to the Height of each Triangle in the *Polygon*, and their Baſes will be alſo equal, becauſe they are *Sides* of a *Regular Polygon.*

Thus in a *Hexagon*, whoſe Side is 8 Yards, and the Diſtance from the Centre to the Middle of any of the Sides 10 Yards.



The Sum of the Sides is 6 × 8 = 48, whoſe half is 24, which multiplied by 10, produces 240 Yards, the Area of the *Hexagon.*

7. *For all Circles*, multiply half the Circumference by the *Radius*, becauſe every Circle is equal to a Rectangle △, one of whoſe Legs is the Periphery, and the other the *Radius*, as *Archimedes* hath demonſtrated. For Practice, meaſure the Semi-diameter, then ſay, As 1000 : 3141 :: So is the Semi-diameter : To the Circumference : Which found, multiply by half the Diameter (or *Radius*) the Produce is the *Area.*

8. *For a Sector of a Circle*, multiply the *Radius*, or one of its Legs by half the Arch (or half the *Radius* by the whole Arch) the Product gives the Content.

9. *For all Segments of Circles*, find the *Area* of

the *Sector* inſiſting on the Ark, and alſo the *Area* of the Triangle, and ſubtract that of the Triangle from that of the *Sector*, the Remainder is the *Area* of the Segment.

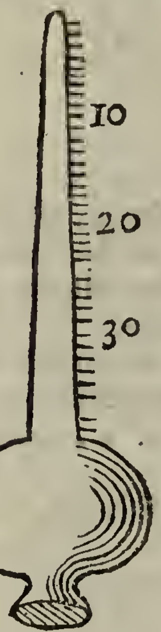
10. *For an Ellipſis*, multiply the longeſt Diameter by the ſhorteſt, and extract the Square Root of the Product, it gives the Diameter of a Circle, whoſe *Area* is equal to the *Area* of the *Ellipſis*; becauſe the Diameter of ſuch a Circle is a mean Proportional between the Diameters of the *Ellipſis*.

11. *For a Parabola*, multiply the entire Ordinate by the *Abſciſſa* or intercepted Ax; then double that Product, and divide the whole by 3; the Quotient is the *Area*.

AREA, (*Aſtronomy*,) a Circle about the Moon and ſome Stars, otherwiſe called *Halo*. *L.*

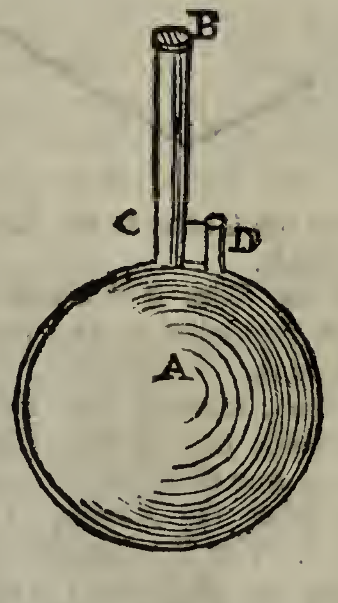
AREA, (in *Fortification*,) the ſuperficial Content of any Rampart or other Work.

AREOLA *Papillaris*, a darkiſh colour'd Circle about the Nipple.



AREOMETER, (of 'Ἀὴρ and μετρέω, *Gr. to meaſure*,) is an Inſtrument to meaſure the Gravity of Liquor. 'Tis uſually made of a thin fine Glaſs of this Figure, and ſealed at the Top, there being firſt as much running Mercury put into it as will ſerve to keep it ſwimming in an erect Poſition. The Stem is divided into Degrees, and by the Depth of its Deſcent into any Liquor, its Lightneſs is concluded; for that Fluid or Liquor in which it ſinks leaſt, muſt be heavieſt, and that in which it ſinks loweſt, will be lighteſt.

Beſides this, Mr. *Homberg* of *Paris* hath invented a new Inſtrument of this Kind, which is deſcribed in *Philoſ. Tranſ. N.* 262. Thus *A* is a Glaſs Bottle or Matraſs, with ſo ſlender a Neck, that a Drop of Water takes up in it about five or ſix Lines, or 6 12ths of an Inch. Near that Neck is a ſmall capillary Tube *D*, about ſix Inches long, and parallel to the Neck.



When the Veſſel is filled, the Liquor is poured in at the Mouth *B* (which is widened to receive a Tunnel) till it run out at *D*; that is, till it riſe in the Neck to the Mark *C*, by which Means you have always the ſame Bulk or Quantity of Liquor; and conſequently, can eaſily tell when different Liquors fill it, which weighs moſt, or is moſt intenſively heavy. But ſome Regard is to be had to the Seaſon of the Year and Degree of Heat and Cold in the Weather: For ſome Liquors will rarify with Heat, and condenſe with Cold; and accordingly take up more or leſs Room. *See the Memoires of the* French *Academy of Sciences for the Year* 1699.

AREOSTYLE, ('Ἀρεόστυλη, *Gr.*) in *Architecture*, is a Building where the Columns ſtand a little too thick, as ſome ſay; or as the *French Dictionary of Arts and Sciences* expreſſes it, *Loin a Loin*, that is, at a convenient Diſtance.

AREOTECTONICKS, (of Ἄρης *Mars*, and τεκτονικὴ, *Gr.*) is that Part of Fortification and Military Architecture which teaches how to attack ſafely, and to fight an Enemy advantageouſly.

AREOTICK *Medicines*, (of Ἀραιός, *Gr.*) are ſuch as open the Pores of the Skin, and render them large enough for the morbifick Matter to be carried off by Sweat, or inſenſible Tranſpiration. *Blanchard.*

ARGEMA, ('Ἄργεμα, *Gr.*) a little Ulcer of the Eye in the Circle of the *Iris*, having its Seat in a Part of the White, and alſo ſome Part of the Black of the Eye. *Blanchard.*

ARGENT, (*Argentum*, *L.*) Silver.

ARGENT, the Name in *Heraldry* for the white Colours which are uſed for Gentlemen, Knights and Baronets: But Barons, and all Nobles, have the white Colour called *Pearl*, as all Sovereign Princes have it called *Luna*: Without either this or *Or*, the Heralds ſay there can be no good Armory. This is expreſſed in Engraving, by the Parts being left plain without any Strokes from the Graver.

ARGO, *or Navis*, (in *Aſtronomy*,) is a Conſtellation of fixed Stars in the *Southern* Hemiſphere. See *Star* and *Conſtellation*.

The Stars in the Conſtellation *Argo*, in *Ptolemy*'s Catalogue are 8; in *Tycho's* 11; in the *Britannick* Catalogue 25.

ARGONAUTICKS, Poems on the Expedition of *Jaſon* and his Companions in fetching the *Golden Fleece*.

ARGUMENT, (in *Aſtronomy*,) is an Ark by which we ſeek another Ark unknown, and proportional to the firſt; as the

ARGUMENT *of Inclination*, is an Ark of the Orbit intercepted between the Node aſcending, and the Place of the Planet from the Sun, being numbred according to the Succeſſion of the Signs.

ARGUMENT *of the Moon's Latitude*, is her Diſtance from the *Dragon*'s *Head* and *Tail*, *viz.* where the Orbit of the Moon in two Points diametrically oppoſite, is interſected by the Ecliptick, whereby we find out the Quantity of the real Obſcuration in Eclipſes, or how many Digits are darkened.

ARGUMENT, with *Painters*, &c. the Perſons repreſented in a Landskip, in Contradiſtinction to the Country or Proſpect.

ARGYROCOMUS, (Ἀργυροκόμος, *Gr.*) according to ſome Writers, is a Silver-colour'd Comet differing very little from the Solar Comet, except that it is of a brighter Silver Colour, and ſhines with ſo great a Luſtre, that it dazzles the Eyes of the Beholders.

ARIES, (in *Aſtronomy*, the *Ram*,) a Conſtellation or Sign of the *Zodiack*. See *Sign*, *Conſtellation*, and *Zodiack*.

The Stars in the Conſtellation *Aries*, in *Ptolemey*'s Catalogue, are 18; in *Tycho*'s 21; in the *Britannick* Catalogue 65.

ARIETUM *Levatio*, an old ſportive Exerciſe, frequently forbidden in our Epiſcopal Synods and Conſtitutions, and ſeems to have been the ſame with the Quintane or Quintal, as Dr. *Kennet* thinks. *See his Paroc. Antiquities.*

ARISTA, (in *Botany*,) ſignifies that long ſlender Needle-like Beard which grows out from the Husk of Corn or Graſs: By ſome 'tis called the *Awn.*

ARITHMETICAL *Complement of a Logarithm*, is what that Logarithm wants of 10.0000000. That the Arithmetical Complement of 7.1079054 is 2.8920946, where each Figure but the laſt is taken from 9, and that from 10.

ARITHMETICAL *Progreſſion*, or *Proportion*: See the Word *Progreſſion.*

ARITHMETICK, ('Αριθμητικὴ, *Gr.*) is the Art of Numbring truly; or, as ſome define it, the Science of Diſcrete Quantity: 'Tis divided into two general Branches; *Common Arithmetick*, and *Algebra.*

Theoretical ARITHMETICK, is the Science of the Properties, Relations, *&c.* of Numbers conſidered abſtractedly, with the Reaſons and Demonſtrations of the ſeveral Rules.

Practical ARITHMETICK, is the Art of computing; that is, from certain Numbers given of finding certain others, whoſe Relation to the former is known.

Inſtrumental ARITHMETICK, is that where the common Rules are performed by the Means of Inſtruments, contrived for Eaſe and Diſpatch; as *Napier's Bones*, &c.

Logarithmetical ARITHMETICK, is that which gives the *Calculus* of Numbers, or of determinate Quantities by the common numeral Quantities.

Specious ARITHMETICK, is that which gives the *Calculus* or Quantities, by uſing the Letters of the Alphabet inſtead of Figures.

Decadal ARITHMETICK, is that which is performed by a Series of ten Characters, ſo that the Progreſſion is from 10 to 10.

Dyadick ARITHMETICK, is that in which only two Figures, 1. and 0. are uſed.

Tetractick ARITHMETICK, is that wherein only the Figures 1, 2, 3. are uſed.

Vulgar ARITHMETICK, is that which is converſant about Integers and Vulgar Fractions.

Sexageſimal ARITHMETICK, is that which proceeds by Sixties, or the Doctrine of Sexageſimal Fractions.

Decimal ARITHMETICK, is the Doctrine of Decimal Fractions.

Political ARITHMETICK, is the Application of Arithmetick to Political Subjects, as the Strength and Revenues of Kings, Births, Burials, the Number of Inhabitants, *&c.*

ARITHMETICK *of Infinites*, is the Method of ſumming up a Series of Numbers, conſiſting of Infinite Terms, or of finding the *Ratio*'s thereof.

ARITHMETICK. Authors on this Subject are,

Wingate's Arithmetick, the laſt Edition.

Tacquet's Arithmetick, in *Latin* or *Engliſh.*

Willisford's Arithmetick, Natural and Artificial. *Lond.* 1656. a good old Book.

Diophanti Alexandrini Arithmeticorum Lib. 6, *& de Numeris Multangulis Lib. unus*, *cum Commentariis G. Bocheti*, *& Obſervationibus P. P. de Fermat. cui acceſſit Doctrinæ analyticæ inventum novum. Toloſæ.* 1670. *Folio.*

Moor's Arithmetick.

Parſons's and *Waſtall*'s Arithmetick and Algebra.

Jeak's Arithmetick. *Fol.*

Wells's Arithmetick in *Latin. Oxon.*

Sir *Iſaac Newton*'s *Arithmetica Univerſalis. Cantab.* 1607.

Ward's *Arethmetick*, *in his young Mathematician*'s *Guide.*

ARK, the ſame with *Arch*; which ſee.

ARK of *Direction*, or *Progreſſion*, (in *Aſtronomy*,) is that Ark of the *Zodiack* which a Planet appears to deſcribe when its Motion is forward according to the Order of the Signs.

It is alſo, in the *Ptolemaick* Syſtem, the Ark of the *Epicycle*, which a Planet deſcribes when it is progreſſive according to the Order of the Signs.

ARK *of Retrogradation*, is that which a Planet deſcribes when it is retrograde, or moves contrary to the Order of the Signs.

ARK *of the firſt and ſecond Station*, is the Ark which a Planet deſcribes in the former or the latter Semi-circumference of his *Epicycle* when it appears *ſtationary.*

ARM, (*in Geography*,) a Branch of a Sea or River.

ARMA *deponere*, (*in Law*,) to lay down Arms, a Puniſhment enjoined when a Man hath committed an Offence. *L.*

ARMA *Reverſata*, inverted Arms, a Puniſhment when a Man is found guilty of Treaſon or Felony.

ARMARIUM *Unguentum*, the ſame with the *Hoplo-Chriſma*, *Magnes Microcoſmicus*; or a Weapon Salve, whereby Wounds, as they pretend, may be cured at a Diſtance, by dreſſing the Weapon only. They preſcribe it to be made of the Fleſh of a Man hanged, or which died ſome ſuch violent Death, at the Increaſe of the Moon, and in a good Sign, *&c.* according to the fooliſh and wicked Superſtition of Aſtrologers. See a good Refutation of this Impoſture, and of the Arguments brought for it by the Author of *Philoſophiæ Moſaicæ*, *in Athan. Kircher de Magnete*, *lib.* 3. *pars* 7.

ARMED, is ſaid at Sea, of a Man of War fitted out and provided in all Reſpects. Alſo a Croſs-Bar-Shot is ſaid to be *armed*, when ſome Rope-Yarn, or the like, is rolled round about one End of the Iron Bar which runneth through the Shot, both that the Shot may be the better rammed down into the Gun, and alſo chiefly, leſt the ſharp End of the Bar ſhould catch into any Honey-combs within the Cylinder of the Piece.

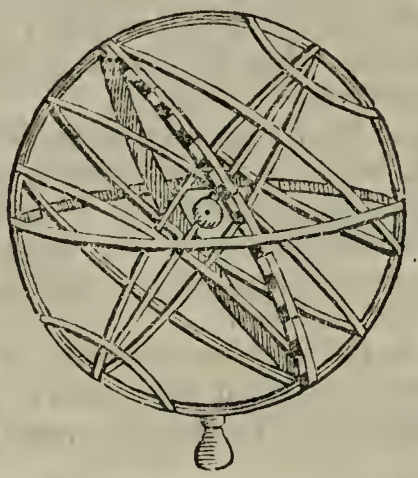
A Load-ſtone is alſo ſaid to be *armed*, when it is *capped* or *caſed*, or ſet in Iron, in order to make it up the greater Weight, and alſo to diſtinguiſh readily its Poles. *Kircher*, in his Book *de Magnete*, tells us, That the beſt Way to arm a Loadſtone, is to drill a Hole through the Stone from Pole to Pole, and in that to place a Steel Rod of a moderate Length; which Steel Rod will, he ſaith, at the End, take up more Weight, than the ſame Stone armed the common Way can do; as he ſaw tried at *Rome.*

ARMED, is the proper Term in *Heraldry* for Blazoning the Beaks and Feet of Cocks, and all Birds of Prey; and theſe are always painted of a different Colour from the Bird it ſelf, and therefore they ſay he beareth a Cock, or a Falcon *armed Or*, *Gules*, &c.

ARMILLA *membranoſa*, (*Anatomy*,) the annular Ligament, a Ligament, Band, or String, which comprehends the other Ligaments of the Hand in a ſort of a Circle. *L.*

ARMILLARY *Sphere*, is when the greater and leſſer Circles of the Sphere being made of Braſs, Wood, Paſte-board, *&c.* are put together in their natural Order, and placed in a Frame, ſo as to repreſent the true Poſition and Motion of thoſe Circles.

See the Figure following.



ARMINGS, in a Ship, are the ſame with *Waſt-cloaths*, which are red Cloths hung about the Outſides of the Ship's upper Works fore and aft, and before the Cubbridge-heads; and there are ſome alſo hung round the Tops, and theſe are called *Top-Armings*.

ARMONIACK *Salt*: See *Sal Armoniack*.

ARMONIACK *Volatile Spirit*: See *Volatile Spirit of Sal Armoniack*.

ARMOR, } (*in Law*,) any thing that a Man
ARMOUR, } either wears for his Defence, or that he takes into his Hand in his Fury or Rage, to ſtrike or throw at another.

ARMORY, the ſame with *Heraldry*, being the Art of truly Blazoning and Marſhalling all Coats of Arms, and appropriating them to their proper Bearers.

ARMS *of Courteſy*, } thoſe Arms anciently uſed
ARMS *of Parade*, } in Juſts and Tournements, as Swords without Edge or Point, and ſometimes wooden Swords, and alſo Canes, Lances not ſhod, *&c.*

Charged ARMS, (*Heraldry*,) are ſuch as retain their ancient Integrity, with the Addition of ſome new honourable Charge or Bearing.

Intire ARMS, } (*in Heraldry*,) are ſuch as retain
Full ARMS, } their primitive Purity, Integrity, and Value, without any Alterations, Diminutions, or Abatements.

Vocal ARMS, (*in Heraldry*,) ſuch wherein the Figures bear an Alluſion to the Name of the Family.

AROMATICK, (*Aromaticus*, *L.* of Αρωματικὸς, *Gr.*) the ſame with *Odoriferous*, or ſweet-ſcented.

AROMATICK *Volatile Salt*, the ſame with *Sal Volatile Oleoſum*; which ſee.

AROMATIZATION, or *aromating of Medicines*, is mingling them with a due Proportion of aromatick Spices, *&c.* in order to make them more grateful and uſeful.

ARONDIE, (*in Heraldry*,) as a croſs *Arondie*, i. e. *rounded*; is a Croſs whoſe Arms are compoſed of Sections of a Circle not oppoſite to each other, ſo as to make the Arms bulge out thicker in one Part than another, but both the Sections of each Arms lying the ſame Way, ſo that the Arm is every Way of an equal Thickneſs, and all of them terminating at the End of the Eſcutcheon like the plain Croſs.

ARQUEBUSE, or *Harquebuſs*, is a large Hand Gun ſomething bigger than our Muſquet; by ſome 'tis called a *Callever*.

ARRAIGN, [*arranger*, *F.*] is to put a Thing in Order, or in its Place.

To ARRAIGN *the Aſſize*, is to cauſe the Tenant to be called to make the Plaint, and to ſet the Cauſe in ſuch Order as the Tenant may be enforced to anſwer thereto.

Alſo a Priſoner is ſaid to be arraign'd, when he is indicted and put to his Tryal.

ARRAY, [*Arraye*,] in *Law*, is the ranking or ordering a Jury or Inqueſt of Men that are impannelled upon any Cauſe.

ARRENTATION, ſignifies the licenſing an Owner of Lands in the Foreſt to encloſe them (with a Hedge and a little Ditch) under a yearly Rent.

Saving of the Arrentation, is the ſaving Power to give ſuch Licences for a yearly Rent.

ARRERAGES, are Duties behind unpaid after the Days and Times in which they are due, and ought to have been paid, whether they be Rents of a Manor, or any other thing reſerv'd.

ARREST, [*Arreſte*, *F.*] is when one is legally taken and reſtrained from his Liberty.

ARRESTANDIS *bonis ne diſſipantur*, is a Writ which lies for him whoſe Cattle or Goods are taken by another, who, during the Controverſy, doth, or is like to waſte and conſume them, and will hardly be able to make Satisfaction for them afterwards.

ARRESTANDO *ipſum qui pecuniam recepit ad proficiendum in obſequium Regis*, &c. is a Writ that lieth for the Apprehenſion of him that hath taken Preſt-money towards the King's Wars, and hides himſelf when he ſhould go.

ARRESTO *facto ſuper bonis mercatorum alienigenorum*, is a Writ that lies for a Denizon againſt the Goods of Strangers of another Country, found within the Kingdom, in Recompence of Goods taken from him in that Foreign Country, after Denial of Reſtitution. This, among the *Civilians*, is called *Clarigatio*, but now barbarouſly *Repriſalio*.

ARRETTED, [in *Law*,] is he that is convented before any Judge, and charged with a Crime.

ARRIERE *Garde*: See *Rear-Garde*.

ARSENAL, is a Royal or publick Magazine, or Place appointed for the making and keeping of all Arms neceſſary either for Defence or Aſſault.

ARSIS & *Theſis*, are certain Terms in Muſical Compoſitions, as where a Point being inverted, is ſaid to move *per Arſin & Theſin*, that is to ſay, where a Point riſeth in one Part, and falls in another; or on the contrary, where it falls in one Part, and riſeth in another; whence is produced a very agreeable Variety.

ARTERIACKS, ['Αρτηριακὰ, *Gr.*) Medicines good againſt Diſeaſes or Diſorders of the Wind-pipe; and which help the Voice.

ARTERY: There are three Kinds of Ducts in an animal Body which bear the Name of *Artery*, the *Aſpera Arteria* or *Trachea*, the *Arteria Pulmonaria*, or *Vena Arterioſa*; both which ſee: And moſt properly, the *Aorta*, or *great Artery*, which carries the ſpirituous Blood from the left Ventricle of the Heart by its Branches, to all Parts of the Body; *this*, and its Ramifications are the only true

Arteries. The Word *Artery*, ſome ſay, is derived from ἀπὸ τȣ̃ αἰρεῖν, becauſe 'tis continually riſing or moving with a Pulſe-like Motion ; and may be defined to be an organical and ſimilar Part, oblong and round, appointed to convey ſpirituous Blood to all Parts of the Body.

The greateſt Artery in the whole Body is the *Aorta*, for that Reaſon often called the *Arteria magna* ; and from it all the Arteries in the whole Body are derived, except the *Arteria pulmonaris*. A brief Account of which, and how they ſpring from the *Aorta*, I ſhall here ſubjoin.

Before it comes out of the *Pericardium*, it ſends out ſometimes one, but oftner two ſmall Arteries, on each Side one, which compaſs the Baſis of the Heart like a Garland in their Circuit, ſending down divers Twigs lengthways on the Heart ; and theſe are called the *Arteriæ coronariæ*. When theſe two ſmall Arteries have encompaſſed the Baſis and meet, they inoſculate one with another, but not with the Veins. At their Riſe out of the *Aorta*, there is a Valve to hinder the Reflux of the Blood into the *Aorta*. Theſe coronary Arteries, Dr. *Ruyſch* obſerves, ſend Branches to the Auricles, and to the very Subſtance of the Heart it ſelf, and to the Root of the Trunk of the *Aorta*.

The aſcending Trunk then running up under the *Vena Cava*, lies upon the Wind-pipe, and preſently ſendeth forth two large Branches, whereof one paſſeth to the right, the other to the left Arm : They are called *Rami ſubclavii*, becauſe they march under the *Claviculæ* ; and as ſoon as they are gone out of the Breaſt, are called *Axillares*. The right is the larger, and riſing higher, goes a more direct Way towards the right Arm ; the left is leſs, and riſing lower, aſcends more obliquely towards the left Arm. They ſend out ſeveral Branches both from their lower and upper Side.

From the lower proceeds the ſuperior Intercoſtal, which runs along the Interſtices or Intervals of the four uppermoſt Ribs, and ſends Slips to the neighbouring Muſcles and ſpinal Marrow : Theſe ſometimes are propagated from the cervical Arteries coming out through the Holes of the *Vertebræ*.

From the upper Side of each Subclavian ſprings firſt the *Mammari*, which deſcends towards the Breaſt through the Muſcles that fill up the Interſtices of the Cartilages of the true Ribs ; and a conſiderable Branch of each deſcending out of the *Thorax* by the Sides of the *Cartilago enſiformis*, run down the *Abdomen* under the *Muſculi recti*, ſpreading there into many Twigs, which are ſaid to inoſculate with the Extremities of the like Twigs of the Epigaſtick Artery aſcending. But that Opinion is ſo oppoſite to the Circulation of the Blood, that it is impoſſible to be true ; for no Blood can aſcend by the *Mammariæ*, nor deſcend by theſe aſcending Twigs of the *Epigaſtriæ*.

The next is *Cervicalis*, (otherwiſe called *Vertebralis*) which ſendeth Slips to the *Vertebræ* and Muſcles of the Neck, at whoſe ſeventh *Vertebra* it enters in by the Holes of the tranſverſe Proceſſes, and pierceth the Membrane that inveſts the ſpinal Marrow, beſtowing Twigs both on the Membrane and Marrow, and runs up therewith in at the great Hole of the *Occiput*, and being entered the Skull, both Branches (the right and left) join under the *Medulla oblongata*, and then are divided into innumerable moſt ſmall Twigs, which make wonderful net-like *Plexus* in the *Pia Mater* about the *Cerebellum*, and run into the Subſtance of the *Cerebellum* it ſelf ; and ſome of them being united with thoſe of the *Carotides*, make Part of the very *Rete mirabile*.

The third Artery that riſeth out of the upper Side of the Subclavian is *Muſcula*, which is ſpent on the Muſcles of the Neck, and ſometimes alſo on ſome of the Arm.

After the Subclavians have had all theſe Pairs of Arteries going out of them, they paſs out of the *Thorax*, and begin to be called *axillar*.

At the ſame Place, or very near, where the aſcending Trunk of the *Aorta* ſends out the Subclavians ſideways, the Remainder of it is divided into two, called *Carotides*, which aſcend directly upwards (though the right ſometimes ariſe from the right Subclavian.) Theſe, at their Riſe, are ſuſtained by the *Thymus* ; and having beſtowed Twigs on the *Larynx*, *Tongue*, the Muſcles of the *Os Hyoides*, and the neighbouring Gland, paſs up on each Side by the Sides of the Wind-pipe to the Jaws, with the internal Jugular Vein, and there are each ſubdivided into the external and internal Branches.

The External is ſmaller, and is diſperſed into all the Muſcles of the Cheeks, Forehead, Temples, Lips, and in general, through all the outer Parts of the Head and Face.

The Internal, which is larger, ſends forth ſome more Twigs to the *Larynx*, *Tongue*, &c. as alſo to the Glands behind the Ears, and the ſpongy Parts of the Palate and Noſe. Then it entreth the upper Jaw, and beſtows a ſmall Slip on the Root of each Tooth (as the external did on the Roots of the Teeth of the lower Jaw) whereby ſharp Humours flowing in upon them, ſometimes cauſe a very painful Tooth-ach. The Remainder of it climbs upon the Skull, being about the Baſis divided into two Branches ; the leſs and hinder whereof having ſent one Slip to the inner Muſcles of the Neck, and another through the Hole of the uppermoſt *Vertebra* into the Membrane that inveſts the ſpinal Marrow, aſcending farther, enters the Skull, at the Hole by which the ſixth Pair of Nerves (commonly ſo called) comes out, and creeping along the *Dura Mater*, ends near its *Sinus* (which yet ſome ſay it enters.) The larger Branch, tending upwards, is carried through the bony Channel in the Wedge-like Bone, with a winding Duct to the *Sella equina* ; at whoſe Baſis, after it has ſent out a Twig on each Side into the *Dura Mater*, it opens it ſelf into many ſmall Slips, which being interwoven with thoſe of the cervical Artery (above-mentioned) make the *Rete mirabile*, which is more obſervable in Beaſts than in Men. Yet it is not all ſpent on the ſaid Slips, but perforating the *Dura Mater*, it enters the *Pia Mater* with two notable Branches, which being divided into very ſmall Twigs, are mingled with thoſe of the cervical Artery, with which they paſs out of the Skull, and accompany the ſpinal Marrow even to the Loins : Afterwards it ſends a ſmall Branch through the ſecond Hole of the Wedge-like Bone with the Optick Nerve, out of the Skull to the Eye ; and yet ſtill ſupplying more Twigs to the Subſtance of the Brain and *Pia Mater*, and being united with ſome other Twigs of the cervical Artery, it makes the *Plexus Choroides*.

The deſcending Trunk of the *Aorta*, which is larger than the aſcending, goes down by the Gullet, to which it cleaveth. And hence is a Man that is hot, ſo much cooled with a Draught of cool Drink ; for the Gullet being cooled thereby, the Blood in the *Aorta* contiguous to it, muſt needs be cooled likewiſe.

Before it arrive at the Diaphragm, it ſends out of its hinder Side the Inferior Intercoſtals, which run along the Interſtices of eight or nine of the lower Ribs, namely, thoſe which the Superior Intercoſtals did not ſupply. They likewiſe ſend Sprigs by the Holes of the *Vertebra*, made for the Nerves, to the Marrow of the Back, and to the Muſcles which reſt upon the *Vertebræ*, and alſo to thoſe of the *Thorax*. Sometimes above this, and ſometimes below it, there ariſeth alſo out of the hinder Part of the *Aorta* an Artery called *Bronchialis*, firſt found out and ſo named by *Fred. Ruych*, which accompanies all the *Bronchia* of the Wind-pipe.

When it comes to the Midriff, there ſprings out of the *Phrenicæ*, one on each Side ; theſe running all through the Diaphragm, paſs up into the *Mediaſtinum*, and ſometimes into the *Pericardium*.

Then having penetrated the Midriff, it deſcends in one Trunk to the fifth *Vertebra* of the Loins ; in which Paſſage it firſt ſendeth forth the *Cœliaca*, which ariſeth ſingle, and is ſo called, becauſe it ſendeth Twigs to the Stomach. This ſpringeth from the Fore-part of the Trunk at the firſt *Vertebra* of the Loins, and deſcending under the hollow of the Liver, upon the Trunk of the *Vena Porta*, it is divided into two Branches, the *Right* and *Left*.

The *Right*, which is the ſmaller, aſcending, produces in its upper Part the *Gaſtrica dextra*, that comes to the *Pylorus*, whence *Spigelius* calls it *Pylorica* : And beſides, the *Cyſticæ gemellæ*, which are very ſmall, and are diſperſed through the Gall-Bladder. And out of its lower Side there ſpring ;

1. *Epiplois dextra*, which runs through the right Side of the inner or hinder Leaf of the Caul and the *Colon* that it is annexed to.
2. *Inteſtinalis*, beſtowed on the *Duodenum* and Beginning of *Jejunum*.
3. *Gaſtro-epiploi dextra*, on the right Side (to the Middle) of the Bottom of the Stomach, and alſo on the Caul that it is knit to its Bottom.
4. *Hepaticæ*, which are two ſmall ones : Theſe are ſpent on the inveſting Membrane of the Liver (for its *Parenchyma* is nouriſhed by the *Porta*) the *Capſula communis*, the Gall-Bladder, and *Porus Bilarius*.

The Remainder of this Right Branch enters the Meſentery with many Twigs.

The *Left* Branch of the *Cœliaca*, which is called *Splenicus* (ſometimes ſpringing immediately from the *Aorta*) is larger than the *Right* ; and as it goes towards the Spleen, it ſendeth forth of its upper ſide *Gaſtrica major*, which after it hath beſtow'd a Slip upon the upper and middle Part of the Stomach, is divided into two others ; the firſt whereof is called *Coronaria ſtomachica*, which encompaſſes the upper Orifice of the Stomach like a Garland, and ſends many Twigs to the Body of the Ventricle it ſelf ; the other *Gaſtrica ſiniſtra*, which (according to *Diemerbroeck*) is carried towards the right Hand into the upper Part of the Stomach, and to the *Pylorus*. Out of its lower ſide ſprings, firſt, *Epiplois poſtica*, which runs to the hinder Leaf of the *Omentum*, and the *Colon* annex'd to it ; ſecondly, *Epiplois ſiniſtra*, which is beſtowed on the lower and left ſide of the *Omentum*.

Juſt as the ſplenick Branch is entring into the Spleen, there ariſes out of its upper Part *Vas breve arterioſum*, which goeth ſtrait to the left Part of the Bottom of the Stomach ; and the *Gaſtro-epiplois ſiniſtra*, which being ſuſtained by the upper or fore Leaf of the *Omentum*, ſends ſome Twigs thereto, and alſo to the left Part of the Bottom of the Stomach, and to both its fore and hinder Sides, then it enters into the Spleen.

All theſe Arteries ſpring from the *Cœliaca*, and accompany the Veins of the *Porta* of the like Denomination.

The next that ariſeth out of the Trunk of the *Aorta* is the upper Meſenterick, which ſprings from the Fore-part of it as the Celiac did. It accompanies the *Vena meſariaca* of the *Porta*, and runs through all the upper Part of the Meſentery, and beſtows many Branches on the Guts, *Jejunum*, *Ileum*, and that Part of the *Colon* that lieth in the right Hypochonder.

Immediately below this, about the ſecond *Vertebra* of the Loins, there go out of each ſide of the deſcending Trunk of the *Aorta* an emulgent Artery, each of which being after its Riſe divided into two, and ſometimes into three Branches, enters the Kidney on its own ſide. The right ſprings out of it a little lower than the left ; both are ſubdivided into innumerable Twigs in the *Parenchima* of the Kidneys, (all of which are inveſted with the Veins in one common *Capſula* borrow'd from the *Pelvis*) and their Capillaries end in the Glands, wherein the *Serum* that theſe Arteries bring with the Blood is ſeparated therefrom, and carried from them by the urinary *Siphons* into the *Pelvis*.

Next to theſe ariſe the *Spermaticæ* (called *Arteriæ præparantes*). Theſe go out of the Fore-part the Trunk very near together (very ſeldom either of them out of the Emulgents, as the left ſpermatick Vein does) and the right paſſes over the Trunk of the *Vena cava* : About two Fingers Breadth from their Riſe they are each joined with the *Vena præparans* of their own ſide, and deſcend with them in Men, thro' the Proceſs of the *Peritonæum* to the Stones, being divided into two Branches a little before they arrive at them, one of which runs towards the *Epididymis*, and the other to the *Teſtes*. In Women, when they come near the *Teſtes* (or *Ovaria*) they are divided alſo into two Branches, one whereof goes to the *Teſtes*, and the other to the Bottom of the Womb. Next below the Spermatick ſprings the lower Meſenterick out of the Trunk a little before it is divided into the *Rami Iliaci*. This entreth the lower Region of the Meſentery, and diſtributes many Branches to the left Part of the *Colon*, and to the ſtreight Gut ; and laſtly, deſcending to the *Anus*, makes the internal Hemorrhoidal Artery.

Very near to this, out of the Trunk ſtill ariſe the *Lumbares*, reckoned four in Number : Theſe go out of the Back-ſide of the *Aorta*, and are diſtributed not only to the neighbouring Muſcles of the Loins, and to the *Peritonæum*, but enters in at the Holes of the *Vertebra* of the Loins, and run along the Membrane that involves the ſpinal Marrow, and penetrates into the Marrow it ſelf.

Beſides theſe ſome reckon other two, on each ſide one, called *Muſculæ ſuperiores* (which run to the Muſcles of the *Abdomen*) unleſs theſe be two of the four called *Lumbares*.

When the Trunk is deſcended as low as the fifth or laſt *Vertebra* of the Loins, and the Top of the *Os ſacrum*, it begins to climb upon the *Vena cava*, under, or behind which it paſſed thus far : But as it begins to get upon it, it is divided into two equal Branches called *Rami Iliaci*, and at its very Diviſion there ſprings out of it *Arteria ſacra*, whoſe ſmall Twigs entring in at the Holes of the *Os ſacrum*, penetrate into the Marrow contained in it.

The Trunk of the deſcending *Aorta* being divided into the *Rami Iliaci*, theſe are ſub-divided preſently into the interior and exterior Branches. From the interior, which is leſs, proceed three others.

Firſt, The inferior *Muſcula* (called otherwiſe *Glutæa*) which is beſtow'd on the Muſcles, named *Glutæi*, that makes the Buttocks, and alſo on the lower End of the Iliack Muſcle, and the *Pſoas*.

Secondly, The *Hypogaſtrick*, which is large, and at the lower End of the *Os ſacrum* runs to the Bladder and its Neck, and the Muſcles that cover the *Oſſa pubis*. In Men it goes alſo along the two nervous Bodies of the *Penis* as far as the *Glans*; and in Women it is driſtributed in numerous Branches into the Bottom of the Womb and its Neck, out of which, for the greateſt Part, iſſue the *Menſes* in their monthly Purgations. It goes alſo to the *Podex*, where it makes the external Hemorrhoidal Artery.

Thirdly, The *Umbilical Artery*, which aſcending by the Sides of the Bladder, and being inſerted into the *Peritonæum*, proceeds betwixt the two Membranes thereof to the Navel, out of which it paſſes in a *Fœtus* in the Womb, and runs into the *Placenta uterina*: But after the Infant is born, when there is no more Uſe of it, it cloſes up, and turns into the Nature of a Ligament, in ſome Meaſure ſuſtaining the Sides of the Bladder, and hindering it from preſſing on its Neck.

From the exterior Branch of the *Ramus Iliacus* two Arteries ariſe:

Firſt, The *Epigaſtrick*, which turning upwards on the Outſide of the *Peritonæum*, runs betwixt it and the *Muſculi recti* of the Abdomen as high as the Navel, where the mammary Artery meets it, and, according to Tradition, though falſe, inoſculates there with it.

Secondly, *Pudenda*, which ſends forth a notable Artery on each Side into the nervous Body of the *Penis* in Men, and into the *Clitoris* in Women. Hence it is carried inwards by the jointing of the *Oſſa pubis* to the *Pudenda* and Groin, and their Glands, and is ſpent on the Skin of thoſe Parts, and of the Yard, in Men. When all theſe Pairs of Arteries have ariſen out of the *Rami Iliaci*, they run down out of the Abdomen to the Thighs, where they begin to be called *crurales*.

An *Artery* is a conical Channel, conveying the Blood from the Heart to all Parts of the Body. Each Artery is compoſed of three Coats, of which the firſt ſeems to be a Thread of fine Blood Veſſels and Nerves, for the nouriſhing the Coats of the Artery. The ſecond is made of circular, or rather ſpiral Fibres, of which there are more or fewer *Strata*, according to the Bigneſs of the Artery. Theſe Fibres have a ſtrong Elaſticity, by which they contract themſelves with ſome Force, when the Power by which they have been ſtretched out ceaſes. The third and inmoſt Coat is a fine, denſe, tranſparent Membrane, which keeps the Blood within its Channels, which otherwiſe, upon the Dilatation of an Artery, would eaſily ſeparate the ſpiral Fibres from one another. As the Arteries grow ſmaller, theſe Coats grow thinner, and the Coats of the Veins ſeem only to be Continuations of the capillary Arteries.

The *Pulſe* is thus accounted for; when the left Ventricle of the Heart contracts, and throws its Blood into the great Artery, the Blood in the Artery is not only thruſt forward towards the Extremities, but the Channel of the Artery is likewiſe dilated; becauſe Fluids, when they are preſs'd, preſs again to all Sides, and their Preſſure is always perpendicular to the Sides of the containing Veſſels; but the Coats of the Artery, by any ſmall *Impetus*, may be diſtended: Therefore, upon the Contraction of the Heart, the Blood from the left Ventricle will not only preſs down the Blood in the Artery forwards, but both together will diſtend the Sides of the Artery. When the *Impetus* of the Blood againſt the Sides of the Artery ceaſes, that is, when the left Ventricle ceaſes to contract, then the ſpiral Fibres of the Artery, by their natural Elaſticity, return again to their former State, and contract the Channel of the Artery, till it is again dilated by the Syſtole of the Heart. This Diaſtole of the Artery is called its *Pulſe*, and the Time the ſpiral Fibres are returning to their natural State, is the Diſtance between two Pulſes. This Pulſe is in all the Arteries of the Body at the ſame time; for while the Blood is thruſt out of the Heart into the Artery, the Artery being full, the Blood muſt move in all the Arteries at the ſame time; and becauſe the Arteries are conical, and the Blood moves from the Baſis of the Cone to the *Apex*, therefore the Blood muſt ſtrike againſt the Sides of the Veſſels, and conſequently every Point of the Artery muſt be dilated at the ſame Time that the Blood is thrown out of the left Ventricle of the Heart; and as ſoon as the Elaſticity of the ſpiral Fibres can overcome the *Impetus* of the Blood, the Arteries are again contracted. Thus two Cauſes operating alternately, the Heart and Fibres of the Arteries, keep the Blood in a continual Motion.

And this is the Order and Diſtribution of the principal Arteries in the Body, each of which are ſubdivided into others, till at laſt the whole Body is overſpread with moſt minute capillary Arteries; concerning which, there are two things neceſſary to remark: *Firſt*, that the Branches which go off at any ſmall Diſtance from the Trunk of an Artery, unite their Canals into one Trunk again, whoſe Branches likewiſe communicate with one another, and with others, as before; by this Means, when any ſmall Artery is obſtructed, the Blood is brought by the communicating Branches below the Obſtruction, which muſt otherwiſe have been deprived of their Nouriſhment. Theſe Inoſculations are every where apparent, but chiefly in the *Uterus*, *Meſentery*, and Brain: It is the ſame thing with the other Veins: The other thing is, that the Sum of the Orifices of the Branches of any Artery, is greater than the Orifices from the Trunk from which they came; upon which Account the Velocity of the Blood is greatly diminiſhed as it removes further from the Heart. The Proportions the Primary Branches bear to one another, and the *Aorta* to the *Cava* and Pulmonary Artery, are as follow:

The *Aorta*	100000
Right ſubclavian Artery	20101. 9
Left *Carotide*	10016
Left Axillary	14456. 7
Bronchial Artery	434. 2
24 Intercoſtals, each 434.2	10420. 8
Cœliack	4830. 3
Meſenterick	7307. 8
Right Emulgent	4639
Left Emulgent	4639
Inferior Meſenterick	3015
Six Lumbals, each 442.2	2605. 2
Left Iliac	9739. 8
Right Iliac	10535
The Sum of all the Branches	102740. 7
The Pulmonary Artery	139291. 8
The aſcending *Cava*	92373
The deſcending *Cava*	92373

ARTERIA *Bronchialis*, is a ſmall Artery, deſcribed by Mr. *Ruyſh*, which in the Lungs creeps along upon the Branches of the *Trachæa*, or the *Bronchia*.

ARTERIA *Venoſa* : See *Pulminaria Arteria.*

ARTERIES and VEINS.

A Deſcription of the Veins and Arteries of a Human Body, in the two Plates annexed, as preſented to the Royal Society in London, *by that generous Promoter of all uſeful Learning,* John Evelyn, *late of* Say's Court *in Deptford, Eſq*; *and explained and illuſtrated by that accurate Anatomiſt and Surgeon, Mr.* William Cowper.

* *Fig.* 1*ſt*, 6*th*, *and* 8*th.* THESE * Figures are cloſely drawn after the original Schemes, and I am apt to flatter my ſelf they will be acceptable to the Inquiſitive. It is ſome Satisfaction, that I find the Arteries here ſo agreeable to a Figure which I drew and publiſhed not long ſince, from the Arteries of a *Fœtus* injected with Wax. But this Figure of the Veins differs ſo much from any extant, as would incline one to ſuſpect all the of Subject hitherto publiſhed are fictitious, not excepting even thoſe of *Veſalius.* But firſt of the *Arteries.*

That the Arteries are the Veſſels which convey Blood from the Heart to all Parts of the Body, is well known ; and we ſee by *Fig.* the 1*ſt*, that the common Practice of Nature in diſtributing theſe Veſſels, to ſupply the Parts with Blood, is from the next adjacent Trunk, till their aſcending and deſcending Trunks become conical, as well as their collateral Branches: Not that all the Trunks and Ramifications of Arteries are uniform, and become conical in the ſame Manner ; nor do all of them paſs directly to the Parts to which they convey Blood; nor do all Parts receive Arteries from the neighbouring Trunks.

The Trunks of the *Carotid*, *Vertebral*, and *Splenick* Arteries, are not only contorted in their Progreſs, in the Adult, but the Diameters of their Bores are variouſly dilated in divers Parts of them, eſpecially where they are contorted ; but as theſe Dilatations of their Trunks are cauſed by the Reſiſtance the Blood meets with at thoſe Angles of Inflection ; ſo thoſe Enlargements of them afterwards contribute to retard the Protruſion of the Blood to the Extremities of thoſe Arteries: Hence it is, that as the Arteries of the *Fœtus* are not contorted in ſuch acute Angles as in full grown Bodies, ſo their Trunks are more conical, and not here and there dilated in divers Parts of them, as in the Adult.

The Trunk of the ſplenick Artery has a ſtrait Progreſs in the *Fœtus* in Infants ; but in the Adult I have hitherto conſtantly found it very much contorted, as is expreſſed in *Fig.* 1, 2, 3.

The peculiar Contrivances of the ſpermatick Arteries of Quadrupeds, as well as Men, ſhew a conſtant Deſign in Nature of taking off that Velocity with which the Blood would otherwiſe paſs through the Glands of the *Teſtes :* It ſeems to be for this End that the *Teſtes* of moſt Animals, eſpecially Men and Quadrupeds, hang out of the Cavities of their *Abdomens*, that the Canals of their Blood Veſſels may be lengthened : For the ſpermatick Arteries, contrary to all others, ariſe from their great Trunk, at a far greater Diſtance from the *Teſtes* than the Arteries of any other Part of the Body. Nor would the *Teſtes*, (which are ſuch neceſſary Organs) have been thus expoſed to external Injuries, if the End of Nature in lengthening their Blood Veſſels, had not been very conſiderable. Beſides this lengthening of the ſpermatick Arteries, we find Nature ſtill contriving other Impediments to check the Current of the Blood in thoſe Parts ; it ſeems for this End, that the ſpermatick Arteries are leſſened at their Original from the Trunk of the *Arteria Magna* in Men, and that the ſpermatick Arteries of Quadrupeds are ſo much contorted before they reach their Trifles.

The principal Inducement of Nature in making uſe of theſe different Contrivances in the ſpermatick Arteries of Men and Quadrupeds, ſeems to be,

That if the Human ſpermatick Arteries were contorted, as in Quadrupeds, before they reach their *Teſtes*, the Apertures in the abdominal Muſcles of Men muſt be much larger than they now are, and would frequently let the Inteſtines deſcend into the *Scrotum* ; which we know nevertheleſs often happens: Such *Ruptures*, as they are called, are not ſo incident to Quadrupeds, though the Paſſages for their ſpermatick Veſſels (through their abdominal Muſcles) are much wider than in Men, becauſe the Poſition of the Trunks of their Bodies is horizontal, and their Inteſtines therefore cannot preſs on the Proceſſes of the *Peritonæum*, as in Men, who are erect.

Beſides theſe Artifices in diſpoſing the Trunks of Arteries, I doubt not much more will be detected by the Inquiſitive : In the mean time, I ſhall, at preſent, purſue the Thread, and deſcribe the Extremities of the Arteries, with their Communications with the Veins, and afterwards produce ſome Inſtances of the Art of Nature in conveying the refluent Blood to the Heart.

After the Circulation of the Blood through the Heart, Lungs, and large Blood Veſſels, was demonſtrated by Dr. *Harvey*, it was only gueſs'd how the Extremities of the Arteries tranſmitted the Blood to the Veins, till Mr. *Lewenhoeck*'s *Microſcopes* had diſcovered the Continuation of the Extremities of thoſe Veſſels in *Fiſh*, *Frogs*, &c. which is now commonly ſhewn by Microſcopes made by other Hands : Yet there are not wanting thoſe, who doubt of the like Continuations of the Extremities of Arteries and Veins in human Bodies and Qua-

Fig: 2

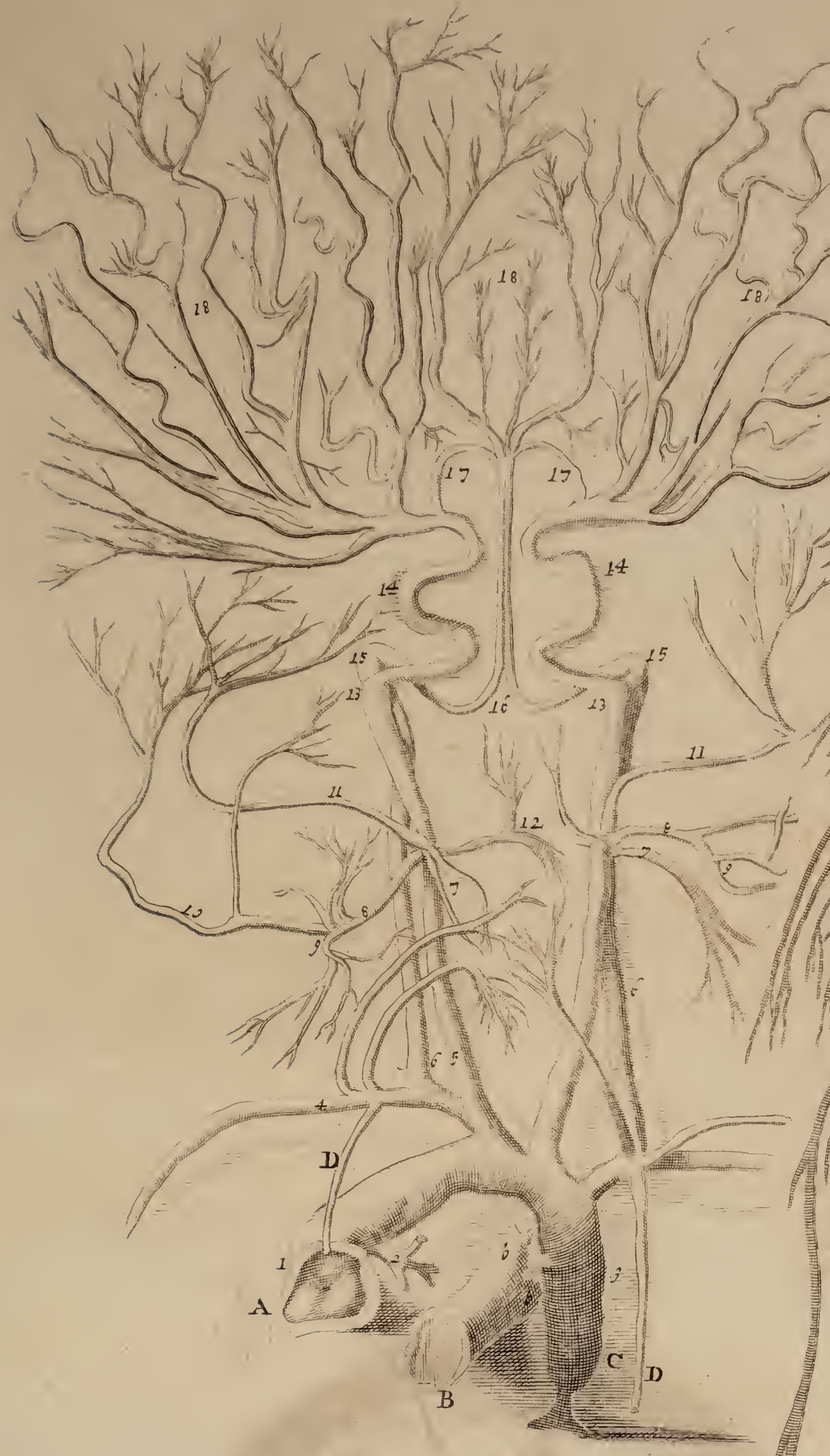


Fig: 1

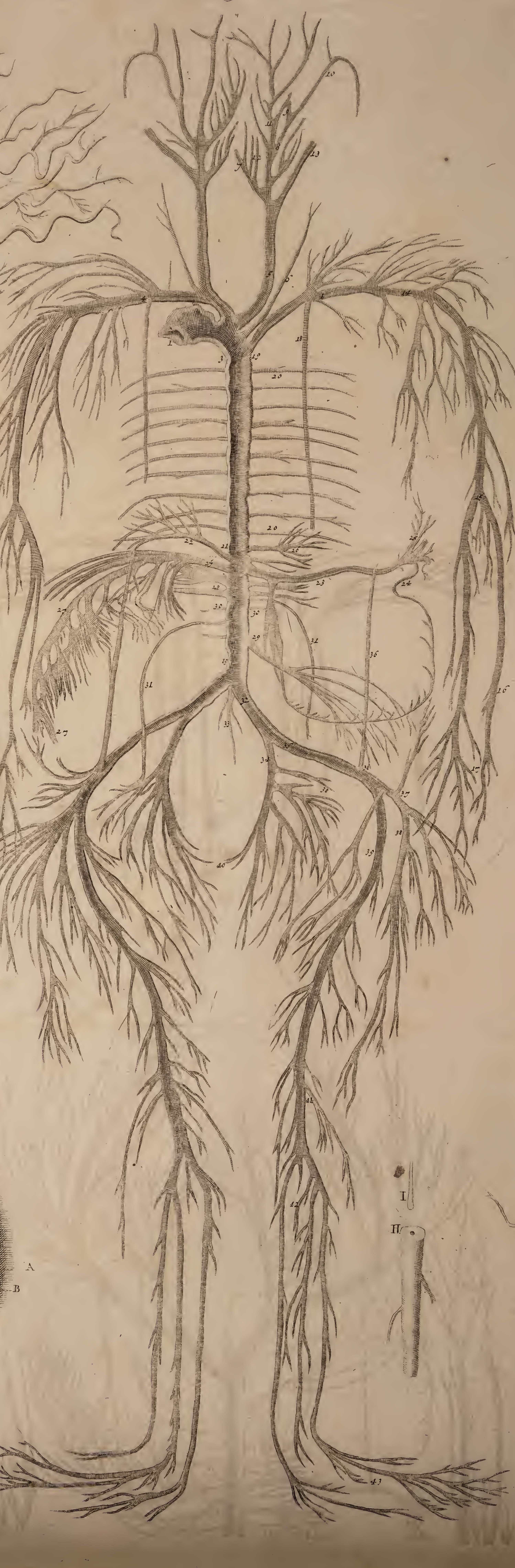


Fig: 3

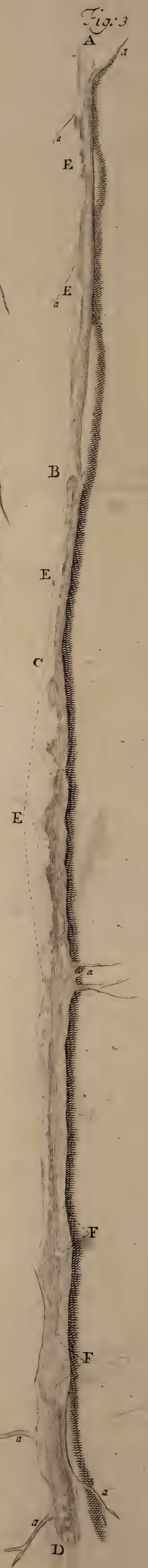


Fig: 4

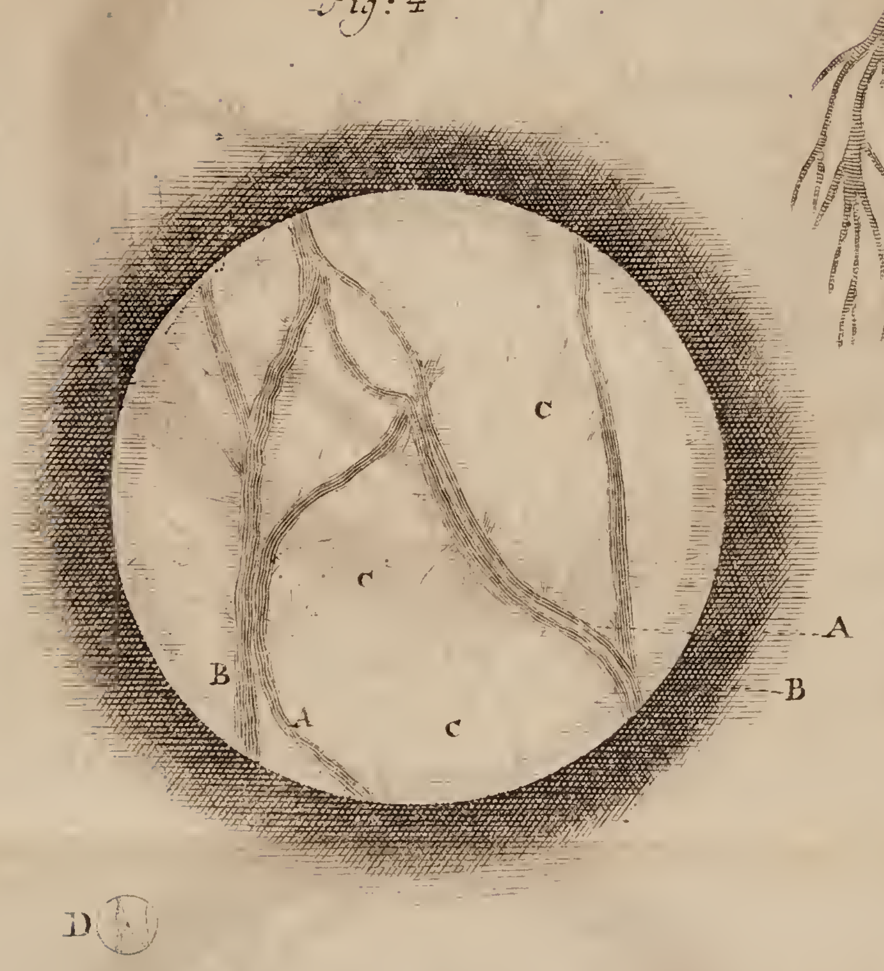
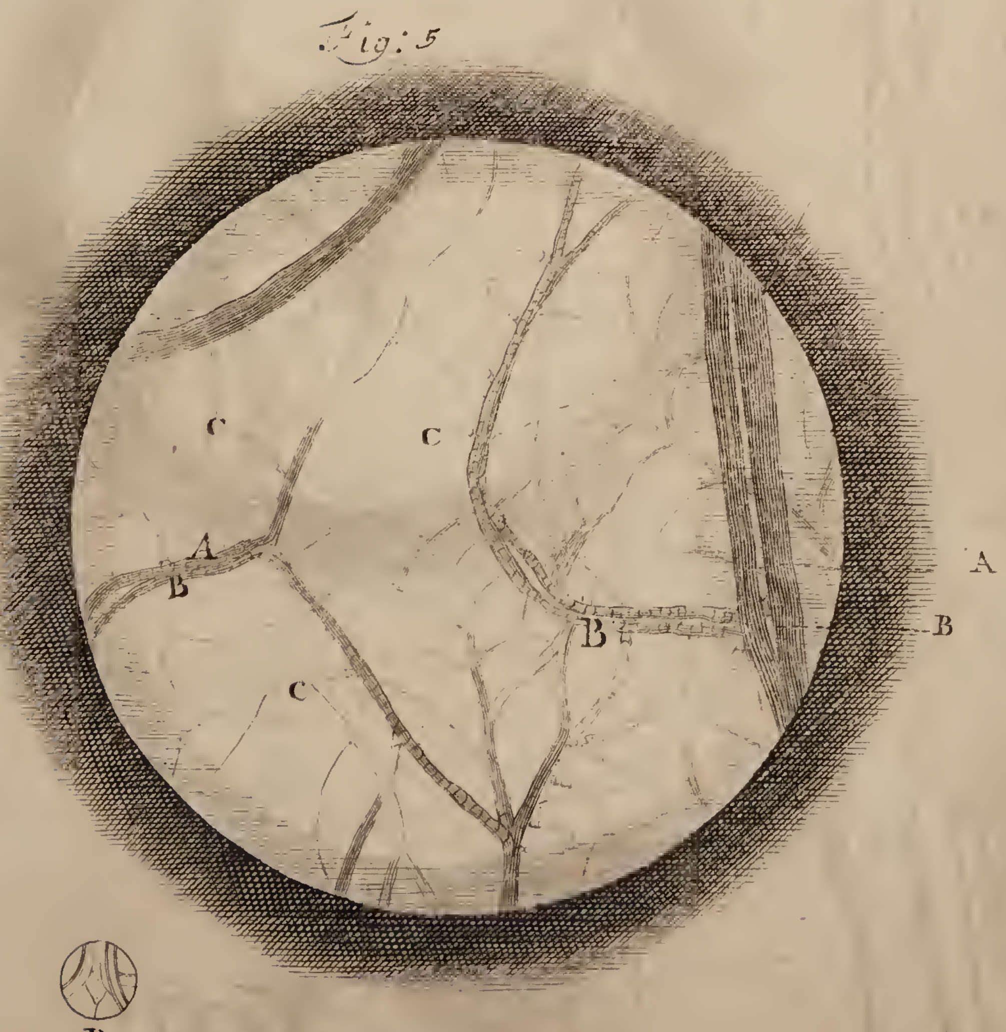
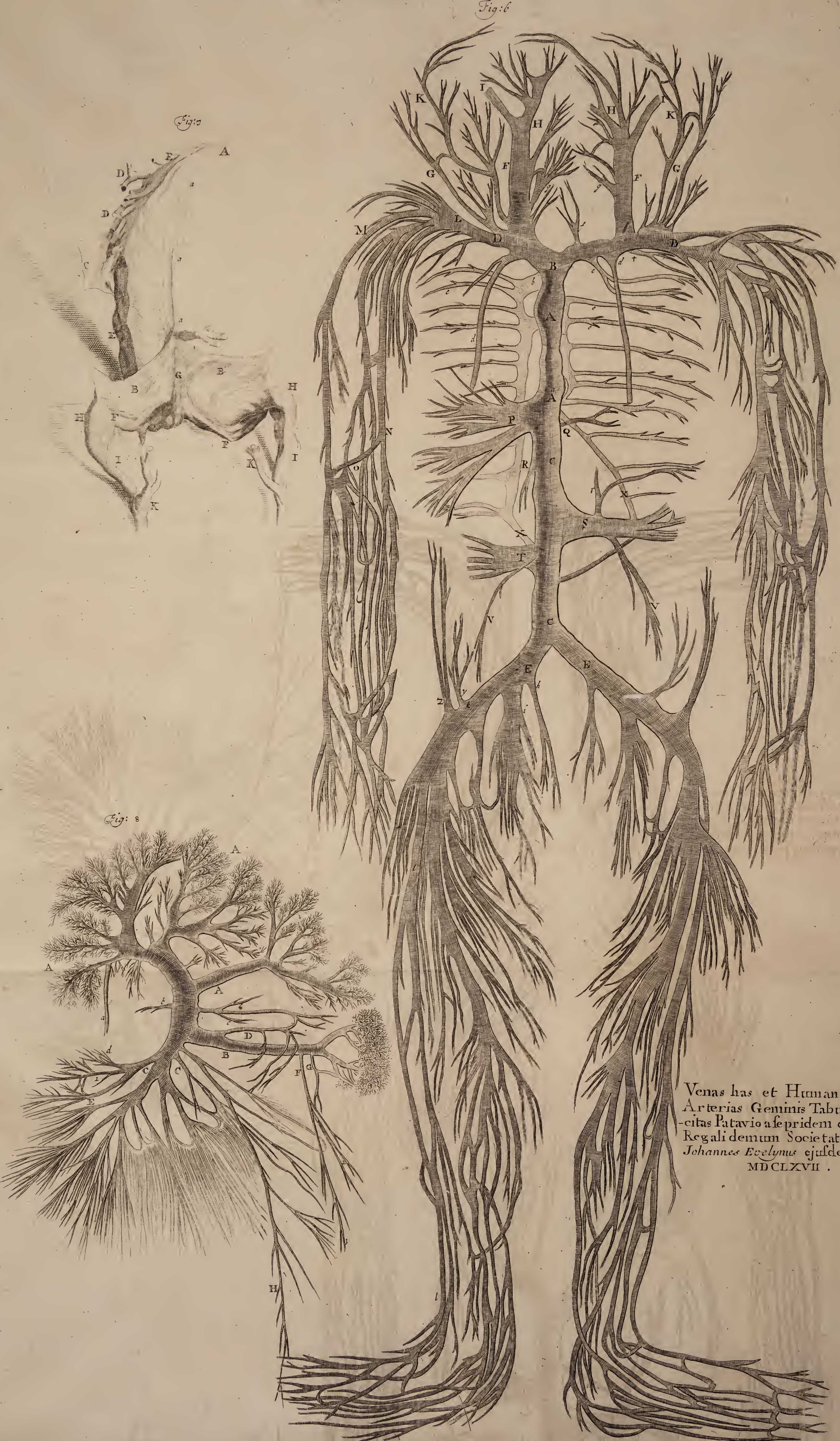


Fig: 5



Place this at the word Arteries



Venas has et Humani Corporis
Arterias Geminis Tabulis adpli-
-citas Patavio aſepridem deductas
Regali demum Societati dedit
Johannes Evelynus ejuſdem Socius
MDCLXVII.

Place this at the word Arteries

Quadrupeds; ſince thoſe Animals it has hitherto been ſeen in (to any Satisfaction, as Mr. *Lewenhoeck* confeſſes) have been either ſuch Fiſh, or of the amphibious Kind, that have but one Ventricle in their Hearts, and their Blood actually cold, except in *Bats*, in which it appears very obſcurely: Add to this, that the Blood in thoſe Creatures does not circulate with ſuch Rapidity as in Animals whoſe Hearts have two Ventricles. For all Animals that have biventrous Hearts, the Veſſels of the reſt of the Body return their Blood to the Heart in equal Time and Quantity with thoſe of the Lungs, notwithſtanding the Inequality of their Courſe.

This Difference in the principal Organs of the Circulation of the Blood in thoſe Creatures (on which only theſe Experiments have been hitherto made) mov'd me to make ſome on Animals, whoſe Organs differ only from the Human in their groſs Figure, and not in their intimate Structure: For this End I took a young Cat, about 10 or 12 Days old, and faſtened it to a Board as in Viveſection, and making an Inciſion through the *Linea alba*, the *Omentum* and Inteſtines were extruded, then cauſing the Creature to be ſo held, on the Board, under a large double Microſcope, where a flat Glaſs for receiving of Objects was placed horizontally, on which I expanded the *Omentum* or Caul, (a Light being placed underneath) I ſaw the Globules of the Blood move very ſwiftly in the ſmall Veſſels, which are only to be ſeen in the moſt tranſparent Parts of the Membranes of its *Omentum*; but the Motion of the Blood ſoon abated, and its Globules were withdrawn from the Extremities of its Blood Veſſels; and in a little time became ſtagnant in their larger Branches.

This Appearance of the Continuation of the Extremities of the Arteries with the Veins, while the Blood was moving in them, in the *Omentum* or Caul, is expreſs'd by *Fig.* 4. A A ſhews the Trunks of the Arteries, B B the Veins, which were diſtinguiſhable by contrary Currents of the Globules of the Blood in each Veſſel. C C C ſhews the branching of the Extremities of the Arteries and Veins, that no longer aſſociate with each other, but are united, as here expreſſed. After I had ſeen this, I attempted to ſhew the like to ſeveral Friends, but did not always ſucceed ſo well as when Mr. *Chambers* and Mr. *Buckeridge* favoured me with their Preſence, at a Time when I happened to have a young lean Dog, that was not large; in whoſe *Omentum* we ſaw it very well; but by the Aſſiſtance of an Inſtrument I had prepared to expand the Meſentery, we all ſaw it there much better, that Part having not only larger and clearer Spaces than the *Omentum*, but its Blood Veſſels are diſtributed more regular, as appears by *Fig.* the 5th, where the ſame Letters of Reference ſerve as above.

Thoſe who will entertain themſelves in viewing the tranſparent Parts of living Creatures with Microſcopes, will find that the Extremities of their Arteries and Veins are not all equally leſſened, tho' united. In the Tail of the *Lacerta Aquatica*, *Tadpols*, and in moſt Fiſh I have examined, I have frequently obſerved ſeveral Communications between the Arteries and Veins; in which more than two Globules of Blood have paſſed a-breaſt: And in the ſame *Area* I have ſeen ſome of thoſe Communications ſo ſmall, as that but one Globule could paſs, and that very ſlowly, before the other. In young Fiſh, particularly in *Grigs*, I have frequently obſerved a communicant Branch, ſo very ſmall, as that one Globule of Blood only has paſſed it in two or three Seconds of a Minute: At other times I have found conſiderable Intervals in paſſing of one Globule in ſuch a communicant Branch, even half a Minute, a whole Minute, and once in two or three Minutes I have ſeen one Globule of Blood only paſs in a particular Track.

The prompt paſſing of Liquors injected by the ſplenick Arteries to the Veins, ſhews the Communications between thoſe Veſſels are more open than the Arteries and Veins of other Parts; of which I have elſewhere ſpoken.

Liquors alſo injected into the pulmonick Arteries paſs to their Veins, though not altogether ſo freely as in the Spleen.

On viewing the Extremities of the Pulmonick Blood Veſſels in a living Frog with my Microſcope, I found their Communications much larger than thoſe that I had before ſeen in the Membrane between the Toes and in the Feet of the ſame Creature. Nor can we reaſonably doubt of the like parent Communications of the Arteries and Veins of human Lungs, and thoſe of Quadrupeds, when we conſider the Blood of their Lungs muſt return to the Heart in equal Time and Quantity with that of all the Parts of the Body beſides, as before noted. Hence it appears, the Bronchial Blood Veſſels (firſt taken Notice of by the accurate *Ruyſch*) are abſolutely neceſſary, elſe the Parts of the Lungs could not receive Nouriſhment; nor could the Glands of the *Bronchia* ſeparate their Liquor, if they were ſupplied with Blood from the Pulmonick Blood Veſſels, which is ſo quickly diſpatched through the Lungs.

On viewing the Membrane that is between the Toes of one of the hinder Feet of a living Frog, after I had frequently taken hold of the ſame Leg of that Creature, to apply it to the Microſcope, I found that Membrane very tranſparent, and without any Motion of the Globules of the Blood in it, as if the Part had been dead; but while I was looking on it, it was, I confeſs, not a little entertaining to ſee the Globules creep into it by Degrees, and at length the Blood move in all the Branches of its Veins and Arteries, as before, when no Violence had been offered to the Part: While the Blood is thus leiſurely creeping through the Veſſels, you may plainly ſee its Globules compreſs'd into oval Figures, which are made more or leſs oblong, by the Reſiſtance thoſe Globules meet with, by the Contraction of the Sides of the Veſſels they paſs through; and this I have more than once obſerved in the Tails of the *Water Newts* or *Lizzards*: But on examining the Blood of theſe Creatures with a Microſcope, and comparing it with the human Blood, I found the Globules of the *Lizzard*'s Blood more incline to an oval Figure, and were as big again as the Globules of human Blood, and that of a ſmall Fiſh; which I in like Manner viewed at the ſame Time. It is not unlikely a ſudden Retroceſſion of Blood, from the Extremities of its Veſſels, often happens, and its Circulation in the ſame Veſſels is afterwards carried on without any Impediment; as on ſome Paſſions of the Mind, *Deliquiums* by the Effuſion of Blood, or otherwiſe. But if the Blood is once become ſtagnant in its Veſſels, eſpecially the Arteries, the Part is in no ſmall Danger of a Mortification, unleſs its neighbouring Veſſels, which enjoy the Motion of the Blood, drive on the ſtagnant Blood, and it eſcape by the Sides of the Veſſels that retained it. Experience aſſures us, that in Bruiſes, when the Blood is extravaſated, it goes off either by *Tranſcolation*, or elſe cauſes an *Abſceſs*; for there's little Reaſon, in my Opinion, to ſuſpect any of the ſtagnant Globules of the Blood will be fit to re-unite with the circulating Maſs. But that the Blood, after Stagnation in its Veſſels, will ſometimes paſs their Sides, appeared to me from the following Experiment.

On viewing the Meſentery of a Dog when living, in which I had before ſeen the Blood paſſing the Extremities of the Arteries and Veins, I conſider'd how to preſerve the Blood in its Veſſels, that I might afterwards at any time ſee it in their Extremities when ſtagnant: For this End, I cauſed ſeveral Parts of the Meſentery to be tied on as many Pieces of ſmall round *Pill-Boxes*, cut tranſverſly like little Hoops; on which, Portions of the Meſentery were extended like the Head of a Drum; and on viewing them afterwards with my Microſcope, I found the Extremities and Branches of the Blood Veſſels charged with Blood, which before appeared in Motion; ſome of which Parts of the Meſentery I ſtill keep by me. On laying one of theſe Parts of the Meſentery (thus expanded) in Water, the ſtagnant Blood in its Veſſels diſappeared; but on juſt immerſing another of thoſe Pieces in Water, I could with my naked Eye ſee the ſtagnant Blood diffuſed in the Interſtices of the Blood Veſſels, and between the Membranes of the Meſentery: Hence it is evident, the Blood may paſs the Sides of its Veſſels after Stagnation in them; but whether its Globules are broken, or what Figure renders them fit to paſs thoſe Pores that are in the Sides of the Veſſels, I leave to the Inquiſitive; but we muſt return to our *Tables*, and firſt of that of the *Syſtem* of the *Vena Cava*.

As the Arteries are known to export the Blood, ſo the Veins carry it back again to the Heart; but having already deſcribed their Extremities, we come next to the large Trunks of the Veins; and here, as in the Arteries, we find the common Practice of Nature, in diſpoſing the Branches of Veins to diſcharge the refluent Blood into the next adjacent Trunk, and ſo on to the Heart. As the Arteries afford Abundance of Inſtances of Checks given to the Velocity of the Current of the Blood through ſeveral Parts, ſo the Veins ſupply us with as many Artifices to aſſiſt its regular Return to the Heart, as well as to favour thoſe Contrivances in the Arteries.

The Trunks of the *Carotid*, *Vertebral* and *Splenick Arteries* are not only variouſly contorted, but are alſo here and there dilated. The Beginnings of the internal Jugulars have a bulbous Cavity (*Fig*. 7. H, H,) which are *Diverticuli* to the refluent Blood in the *Sinus's* of the *Dura Mater*, leſt it ſhould deſcend too faſt into the Jugulars. The like has been alſo taken Notice of by Dr. *Lower*, in the *Vertebral Sinus's*. The ſplenick Vein has divers Cells opening into it near its Extremities in human Bodies, but in Quadrupeds, the Cells open into the Trunks of their ſplenick Veins.

The *Spermatick Veins* do more than equal the Length of the Arteries of the *Teſtes* in Men; their various Diviſions, and ſeveral Inoſculations, and their Valves, are admirably contrived to ſuſpend the Weight of the Blood, in order to diſcharge it into the larger Trunks of the Veins; and were it not that the refluent Blood from the *Teſtes* is a *Pondus* to the influent Blood from the Arteries, and ſtill leſſens its Current in the *Teſtes*, theſe ſpermatick Veins, like thoſe of other Parts, might have diſcharged their Blood into the next adjacent Trunk.

Who can avoid Surprize at the Art of Nature, in contriving the Veins that bring Part of the refluent Blood from the lower Parts of the Body? when they conſider the Neceſſity of placing the human Heart, as well as that of moſt Quadrupeds, ſo far from the Centre of the Body towards its upper Part? It is for that End neceſſary, the large Trunks of the Veins and Arteries ſhould not aſſociate each other; for if all the Blood ſent to the lower Parts by the deſcending Trunk of the *Aorta*, ſhould return to the Heart again by one ſingle Trunk (as it is ſent out from thence) the Weight of ſo much Blood in the aſcending Trunk of the *Vena Cava*, (*Fig*. 6. C, C, A,) (for ſo its lower Trunk is called) would oppoſe the Force the Heart could give it from the Arteries, and hinder its Aſcent: For this Reaſon, the *Vena Azygos* (*Fig*. 6, b.) or *ſine pari*, is contrived to convey the Blood ſent to the Muſcles of the Back and *Thorax* into the deſcending Trunk of the *Vena Cava*, (ib. B.A.) above the Heart: Hence 'tis evident, more Blood comes into the Heart by the deſcending, or upper Trunk of the *Vena Cava* (*Fig*. ib. B. A.) than paſſes out by the aſcending Trunks of the *Aorta*. Nor does this Quantity of Blood, conveyed to the Heart by the ſuperior Trunk of the *Cava*, ſeem without ſome other Deſign in Nature, beſides tranſporting it thither to free the inferior Trunk from its Weight: But perhaps it was neceſſary ſo much Blood ſhould be ready there to joyn with the Chyle, (*Fig*. 6. †.) for its better Mixture, before it reaches the right Auricle of the Heart.

I might here add the Deſcription of a *peculiar Valve*, I lately diſcovered in the lower Trunk of the *Vena Cava*, near the right Auricle of the Heart, but the annexed Figures have taken up too much Room in thoſe Copper Plates to inſert it: For the ſame Reaſon, the Figures of ſome Contrivances in the Arteries here mentioned, particularly the *Spermaticks*, are omitted: This being what occurr'd to my Thoughts at preſent on this Subject, which is not to be found (at leaſt not commonly) in the Books of *Anatomy*; the greateſt Part of which have been added to theſe Papers, on their lying by me, ſince the *Engraver* began the Figures.

The Explication of the Figures.

FIG. I.

REpreſents the Trunks and large Branches of the Arteries, diſſected from an adult human Body, when diſplayed and dried; as they are now to be ſeen in the *Repoſitory* of the *Royal Society*.

1. The Trunk of the *Aorta* cut from the Baſis of the Heart.
2. That Part of it, whence the coronary Artery of the Heart does ariſe.
3. That Part of the *Arteria Magna*, where the *Canalis Arterioſus* of the *Fœtus* terminates; which in an Adult becomes a Ligament. *Vid. Fig*. 2, 3.
4. That Part of the *Axillary Arteries*, by ſome called the *Subclavian Arteries*.
5. The Left *Carotid Artery*, (in this Subject it ſeems) ariſing from a common Trunk with the Right *Carotide* and *Axillary Arteries*, as in ſome Quadrupeds.
6. The Left *Cervical Artery*, in this Subject ariſing from the Trunk of the *Arteria Magna*, as ex-

expreſs'd in a Figure given by *Bergerus* in the *Acta Eruditorum*, *Anno* 1698. *p.* 295. But in all the human Bodies in which I have hitherto examined theſe Arteries, I have conſtantly found them as expreſs'd *Fig.* 2, 6, 6.

7. The Arteries that carry Blood to the lower Parts of the Face, Tongue, adjacent Muſcles, and Glands.

8. The Trunk of the *Temporal Artery*, ſpringing from the Carotid, and parting with Branches to the Parotid Gland 9, and Temples 10, and Parts adjacent.

11. The *Occiputal Arteries.*

12. The Arteries that convey Blood to the *Fauces*, *Gargareon*, and adjacent Muſcles.

13. The Trunk of the *Carotid Artery*, cut off before it is contorted in paſſing the Skull.

14. The Trunk of the Artery of the Arm parting with Branches to the adjacent Muſcles and Parts.

* That Part of this Artery which is ſometimes prick'd in letting Blood, and makes an *Aneuriſma*, in which Caſe this Trunk of the Artery muſt be bared and firmly tied above the *Aneuriſma*; and if it afterwards happens (as it has been frequently known) that the Flux of Blood to the *Aneuriſma* in the Artery is not very much abated, though the Artery has been tied above; the Operator in that Caſe muſt make another Ligature on the Trunk of the Artery below its *Aneuriſma:* Theſe collateral Communications of the Trunk of the Artery at the bending of the Cubit, preſerve the Circulation of the Blood in the Cubit and Head, tho' the Trunk is totally compreſs'd both above and below; and the ſame Trunk afterwards divided between thoſe Ligatures. Hence it is, if one Ligature made above the Wound in the Artery is not ſufficient, but the Blood ſtill pours out from below, the Patient will ſooner recover the Action and Strength of the Muſcles of the Cubit, than thoſe in whom the upper Ligature proves ſufficient; the Reaſon of which is obvious to any who conſider, that the communicant Branches muſt be larger where the lower Ligature is required, than when the ſuperior Ligature only is ſufficient. Theſe communicant Branches (as I have ſeen them in ſome Subjects) are here mark'd out in prick'd Lines, *vid. the Figure.*

While theſe Papers were lying by me, the two following Inſtances happen'd, in which the Communications of the large Trunks of the Arteries of the Cubit and Arm were remarkable. The firſt was,

A Boy of thirteen Years, who, about three Weeks before I ſaw him, received a Wound near the Middle of the Cubit in which the Trunk of the Artery (mark'd in the Fig. †) was divided. The *Surgeon* who was firſt call'd, had frequently bound up the Wound, and put a Stop to the ſeveral Diſcharges of Blood (which they told me did not amount to leſs than ſix or ſeven Quarts at Times,) but not without a Compreſs on the Trunk of the Artery above the Wound. On another impetuous Flux was I call'd; but ſeeing no ſmall Quantity of Blood diſcharged, I was contented to let the Wound be bound up in the ſame Manner as it had been done before; omitting the Compreſs on the Trunk of the Artery above, and adding a Piece of Deal-board, on which the Hand and Cubit were faſtened, to prevent any Motions of thoſe Parts, as well as the Fingers; three Days after the Applications were taken off, and little or no Blood appear'd; but two or three Hours were ſcarce elapſed, e're I was alarm'd with Notice of a freſh Flux. The By-ſtanders being inſtructed in that Caſe, to compreſs the Trunk of the Artery above the Cubit, they had thereby prevented no ſmall Effuſion of Blood, which muſt otherwiſe have happen'd; his Surgeon being out of the Way, I laid the Trunk of the Artery bare above the Wound as expeditiouſly as I could, being forced more than once to let looſe the Compreſs above, to diſcover its Orifice by the Flux of Blood. I paſſed a Needle with ſtrong waxed Thread under the Artery, and made a Ligature on its Trunk, which lay conceal'd in the Interſtice of the *Muſculus Flexor Digitorum*, and the *Muſculus Ulnaris Flexor Carpi*; but notwithſtanding this Ligature on the Trunk of the Artery above the Wound, the Blood ſtill flow'd from the lower Trunk of the divided Artery; yet the Velocity of its Current was ſo much abated, that it ſeemed like Blood flowing from a Vein. I left the Wound with a Digeſtive, and the Part without hard Bandage; it being now five Weeks ſince, I hear the Wound is almoſt cicatrized. The learned Dr. *Harris* was preſent at the other Operation, by which the Communications of the large Trunks of the Arteries of the Arm were very evident.

A Boy about Eight Years of Age, who came to Town with an *Aneuriſma* of the left Arm, upon bleeding ſix Weeks before. The Tumour was indeed very large in Proportion to ſo ſmall an Arm. After laying the *Aneuriſma* or Tumour bare, and making a Ligature on the ſuperior Trunk of the Artery (in the annex'd *Figure* * ....) I found, on looſening the Compreſs on the ſuperior Trunk of the Artery, very little Abatement of the Pulſation of the *Aneuriſma*; I then paſſed a Ligature in like Manner on the Trunk of the Artery below the Tumour; but notwithſtanding the Pulſation continued, though much abated. I then diſcovered another Trunk of the Artery, ariſing from the lower Part of the Tumour, on which alſo I made another Ligature, and the Pulſation was then taken off. However, on cutting off the Surface of the *Cyſtis*, or dilated Artery, and clearing it of the coagulated Blood, which was ſoon ſtopped with a common Aſtringent, I left the Part without any other Ligature or hard Bandage. It is now eighteen Days ſince the Operation, the Ligatures on the Arteries are all come off, and the Pulſation of the Artery of the Wriſt begins to be very manifeſt, nor does any Symptom appear that threatens Succeſs.

15. The Diviſion of the Trunk of the Artery of the Arm below the Flexure at the Cubit.

16. The External Artery of the Cubit, which makes the Pulſe, that is commonly felt near the *Carpus*.

17. The Arteries of the Hand and Fingers.

18. The Mammary Artery.

19. 19. The deſcending Trunk of the *Arteria magna*.

20. 20. The Intercoſtal Arteries.

21. The *Arteria Cœliaca*.

22. The *Arteria Hepatica*.

23. The Trunk of the *Arteria ſplenica*.

24. The *Arteria Epiploica ſiniſtra*.

25. A Branch of an Artery which paſſes to the Bottom of the Stomach.

26. The ſuperior coronary Branch of the Stomach.

27. 27. The ſuperior Meſenterick Artery.

28. 28.

28. 28. The emulgent Arteries.

29. The inferior Meſenterick Artery.

30. 30. The Lumbal Arteries.

31. 31. The two ſpermatick Arteries, which in this Subject ſeem to ariſe at a greater Diſtance from each other than commonly.

32. The Iliac Artery.

33. The *Arteria ſacra.*

34. The Internal Iliac Branch,

35. The External.

36. The Epigaſtrick Artery.

37. Branches of the External Iliac Artery, paſſing to the oblique Muſcles of the Abdomen.

38. 38. The Arteries that paſs to the Muſcles of the Thigh and *Tibia.*

39. The Crural Artery.

40. The Umbilical Artery, with thoſe of the *Penis.*

41. That Part of the Crural Trunk that paſſes the Ham.

42. The three Trunks of the Arteries of the Leg.

43. The Arteries of the Foot and Toes.

FIG. II.

THE Trunks and ſome of the Ramifications of the Arteries of an adult human Body filled with Wax, to ſhew the Variety in Nature, and ſupply the Defects of the former Figure.

1. The *Aorta*, cut off at the Baſis of the Heart.

A. The three ſemilunary Valves, as they appear when the Heart is in Diaſtole, and hinder the Blood coming back from the Arteries into the left Ventricle of the Heart.

B. A Portion of the Trunk of the *Arteria Pulmonalis.* b, b. its Diviſion before it paſſes to the right and left Lobes of the Lungs.

C. The Deſcending Trunk of the *Arteria magna.*

D. D. The Internal mammary Arteries.

2. The Trunk of the Coronary, cut off.

3. The *Ligamentum arterioſum*, which in the *Fœtus* is the *Canalis arterioſus*, and conveys Blood from the Pulmonick Artery to the great Artery.

4. The Trunk of the Subclavian Artery.

5. 5. The Carotids.

6. 6. The Vertebrals.

7. 7. The Arteries which paſs to the lower Parts of the Face, Tongue, adjacent Muſcles and Glands.

8. 8. The Trunks of the temporal Arteries ariſing from the Carotids, giving Branches to the Parotid Glands (9. 9.) and the Temples (10. 10.) *&c.*

11. 11. The Occiputal Arteries.

12. The Arteries of the *Fauces*, *Gargareon*, &c.

13. 13. The Contortions of the Carotid Arteries as they paſs the Baſis of the Skull; theſe Trunks of the Carotid Arteries in Dogs (like thoſe, I gueſs, of moſt Quadrupeds) are very much contorted before they reach the Baſis of the Skull: On filling theſe Veſſels of that Animal with Wax, I found thoſe Branches of them which paſs to the Brain, firſt clipping the hinder Parts of the lower Jaw, immediately under its condiloide Proceſſes; where thoſe Arteries are receiv'd in two *Sinus's* of that Bone; which *Sinus's* may alſo be ſeen in the Jaw-bones of other Quadrupeds, but not in human Bodies.

14. 14. Thoſe Parts of their Trunks that paſs by each Side of the *Sella Turcica*, whence divers ſmall Branches ariſe, and help to compoſe the *Rete mirabile*; which is more conſpicuous in Quadrupeds than in human Bodies.

15. 15. The Contortions of the Vertebral Arteries, where we find their Trunks conſiderably dilated.

16. The Vertebral Arteries, as they aſcend on the *Medulla oblongata* towards the annular Protuberance or *Pons Varoli.*

17. 17. The communicant Branches of the Vertebral and Carotid Arteries.

18. 18. The Arteries of the Brain diſplayed.

FIG. III.

I Chuſe to place this Figure on the Copper Plates of one of the Trunks of the Arteries of the *Tibia* (diſſected from the Leg after *Amputation*) rather than the following Diſtich, which I find written on the *Original Table* of this Scheme of the Arteries.

Pulſificus Sanguis de Cordis Ventre ſiniſtro.
Funditur ut Corpus nutriat hiſce viis.

Before I explain the Letters of Reference of this third Figure, it will be neceſſary to let you know, that Mr *Stringer* was in his Sixty ſeventh Year when this Artery was taken from him, and near Twenty Years before loſt the Uſe of both his Legs; and in that Time he had been ſo perſecuted with Convulſions in them, that neither Leg was free a Quarter of an Hour together, whether ſleeping or waking. At length one of his little Toes mortified, which was taken off by Mr. *Coldwyer*, an expert Surgeon of *Saliſbury*; not long after more Toes of the ſame Foot followed the like Fate: The Convulſions following that Leg ſtronger and quicker, that Part of the Foot next the Toes became tumid and inflam'd, the Tumour extending it ſelf above the *Maleoli*; a ſinuous Ulcer paſſed by the Side of one of the Metatarſal Bones; the Extremity of which Bone (whence the Toe was taken off) lying bare. In this Condition I found the left Foot and Leg of this Gentleman, when I had the Honour to wait on him, by Command of the Right Honourable the Earl of *Shaftsbury*, he living in the Neighbourhood of that noble Peer in *Wiltſhire*; where I met with Mr. *Goldwyer* above-mentioned; and finding the Leg very chilly, the Neceſſity of parting with it was too evident; which Mr. *Stringer* ſuffered with extraordinary Fortitude, he not ſo much as expreſſing the leaſt Outcry during the Operation, though the Part did not want the moſt exquiſite Senſe of Feeling: On the Abſciſſion, which was about five or ſix Inches below the Knee, it was unexpected by me, I muſt confeſs, to ſee ſo little Blood ſpouting from the Arteries. The Stump being bound up, and committed to the Hands of two or three Servants, a leſs Number not being ſufficient to hold it, by Reaſon ſuch ſtrong convulſive Motions purſued the Part on the Operation. I was very deſirous to examine the Arteries of the amputated Leg, having before diſcover'd the Cauſe of a Mortification of the Arm of a young Gentlewoman, who died not long after an Amputation of the Part, tho' the Gangreen did not appear to reach near the Place where the Abſciſſion was made, *i. e.* below the Ending of the *Muſculus Deltoides.* In which Caſe, I found the Sides of the Trunk of the Artery of the Arm ſo thicken'd, that the Diameter of its Bore was contracted to leſs than a third Part, and would ſcarce admit a common *Probe* to paſs it, *vid.* Fig. G, H, I. When I had found the Ends of the Arteries in the Leg above-mentioned, I endeavoured to paſs my *Probe* into one of them, but meeting with ſome Oppoſition, I ſuſpected I had miſtaken the Vein for the Artery, and that the Valves oppoſed the paſſing of the *Probe* that Way; but on further Diſſection I clear'd the Trunks of both thoſe Blood Veſſels, and found the Veins in their natural State; but the Sides of the Arteries were grown bony or ſtony: Having cleared two of their Trunks, I left one of them at *Salisbury*, the other I brought to Town, and is here figur'd.

A. the upper Part of the Artery cut off in the Amputation of the Leg. From A to

B. the Trunk of the Artery diſtended and dried to ſhew its Canal.

C. That Part of the Trunk of the Artery which was ſo contracted by the Putrefaction or Oſſification, that a *Probe* would not paſs its Canal. From C to

D. The Trunk of the Artery opened and expanded.

E, E. The Putrefactions or Oſſifications in the Sides of the Artery.

F, F. Their Specks in the lower Part of the Artery, not ſo large as in the upper Part, and placed at greater Diſtances.

a, a, *&c.* The Branches ariſing from the Trunk of the Artery.

G. A Proportion of the Trunk of the Artery of the Arm above-mentioned.

H. The Sides of the Artery very much thicken'd, whereby the Diameter of its *Canalis* was ſo much diminiſhed, that the *Probe*

I. would not paſs it.

The Oſſifications in the Coats of Arteries have been frequently obſerv'd, eſpecially in their large Trunks within the Cavities of the *Thorax* and Abdomen; but I don't remember the like has been taken Notice of in the Limbs; or that ſuch Impediments in their Canals have been found the Cauſe of Mortifications of particular Parts, as in the Inſtance above-mentioned; though I doubt not, but the like has often happened in aged People, eſpecially where we find the Progreſs of the Gangreen not very ſwift, and its Beginning from no external Cauſe; the Conſequences of which are commonly found fatal. When the Arteries of one Leg (or of any other Limb) are ſo affected, we may well ſuſpect the like in thoſe of other Parts; which probably happened in the Inſtance I now mention'd: for though no Gangreen came on the Stump, yet the other Foot and Toes began to mortify about ſix Weeks after the Amputation, as did the Parts about the Hips, which were compreſs'd in lying or ſitting before he expired.

FIG. IV.

Repreſents the Extremities of the Blood Veſſels, as they appear while the Blood is paſſing them in the *Omentum* of a live Dog, view'd with a Microſcope.

A, A. The Branches of Arteries; and

B, B. The Veins which aſſociate

C, C. Their leſſer Branches where they paſs from each other, and are united at their Extremities.

FIG. V.

THE like appearing in the Meſentery of a Dog when living.

D, D. The *Areæ* that are here viewed with the Microſcope, as they appear to the naked Eye.

FIG. VI.

THE Trunks of the *Vena Cava*, with their Branches diſſected from an adult human Body, done from the original Scheme in the Repoſitory of the *Royal Society*.

A, A. The Orifice of the *Vena Cava*, as it appears when cut from the Right Auricle of the Heart.

a, The Orifice of the Coronary Vein of the Heart.

B, A. The ſuperior or deſcending Trunk of the *Vena Cava*.

C, C, A. The inferior or aſcending Trunk; ſo diſtinguiſhed from the Motion of the Blood in their Trunks, which is contrary to their Poſition.

D, D. The ſubclavian Veins.

† That Part of the Left ſubclavian Vein, where the *Thoracick* Duct enters it, and diſcharges it-ſelf of its Chyle and *Lympha*.

b. The *Vena Azygos* with its Branches going to the Ribs, e, e.

c. The ſuperior Intercoſtal Veins.

d, d. The internal Mammary Veins.

E, E, The Right and Left Iliac Branches.

F, F. The Internal Jugular Veins.

G, G. The External Jugulars.

H, H. The Veins which bring Blood from the lower Jaw and its Muſcles.

I, I. The Trunks of the Internal Jugulars cut off at the Baſis of the Skull.

f, the Veins of the *Thymus* and *Mediaſtinum*.

g, g. The Veins of the *Thyroid Glands*.

h. The *Vena Sacra*.

i. The Internal Iliac Branch.

k. The External ———

K, K. The Occiputal Veins.

L. The right Axillary Vein.

M. The Cephalick.

N. The Baſilick.

O. The Median Vein.

P. The Trunk of the Veins of the Liver.

Q. The Phrenick Vein of the Left Side.

R. The Right Phrenick Vein.

r. A large Vein from the Left *Glandula renalis* and Parts adjacent.

S. The Left Emulgent Vein.

T. The Right Emulgent, in this Subject very much lower than the Left, which is not uſual.

V, V. The two Spermatick Veins.

X, X. Two Communicant Branches between the aſcending Trunk of the *Vena Cava* and *Vena Azygos*, by which the Wind paſſes into the deſcending Trunk of the *Cava*, when we blow into the aſcending at A. P. C. though the Trunk at A, A. and C is firmly tied on the Blow-pipe.

* An uncommon Branch between the lower Trunk of the *Vena Cava* and the Left Emulgent Vein.

y, A Vein which brings Blood from the Muſcles of the Abdomen into the external Iliac Branch.

z. The Epigaſtrick Vein of the Right Side.

I. The *Vena Saphena*.

The reſt of the Branches here diſplayed, commonly differ ſo much in various Subjects, that the particular Deſcriptions of them (which none but the Operator who diſſected them could pretend to be Maſter of) would be perhaps as uſeleſs, as tedious to repeat: Wherefore I paſs to thoſe conſiderable venous Trunks which are wanting in this Scheme.

FIG. VII.

SOME of the large Trunks of the Veins and their *Sinus's* within the Skull, with the Beginnings of the internal Jugular Veins filled with Wax, and dried together with the *Falx*, &c.

A. The Extremity of the *Falx* cut from the *Criſta Galli.*

a. Its lower *Limbus* that toucheth the *Corpus calloſum*, as it divides the Right Hemiſphere of the Brain from the Left; where the fifth *Sinus* paſſes, which are here dried and diſappears.

B, B. The ſecond Proceſs of the *Dura Mater*, which ſupported the hindermoſt Parts of the Lobes of the Brain, and defended the *Cerebellum* from being preſs'd by thoſe Parts of the *Cerebrum.*

C. A Portion of the *Dura Mater* remaining to the Longitudinal *Sinus.*

D, D. Several Trunks of the Veins of the Brain cut off before they enter the Longitudinal *Sinus.*

E, E. The Longitudinal *Sinus's.*

F, F. The two lateral *Sinus's.*

G. The Fourth *Sinus.*

g, The Veins from the *Plexus Choroides.*

H, H. The *Bulbi* or *Diverticuli* at the Beginnings of the internal Jugular Veins.

I, I. The internal Jugular Veins.

K, K. The Trunks of Veins which bring Blood from the lower Jaw and Parts adjacent.

FIG. VIII.

THE Trunks of the *Vena Portæ* diſſected and diſplayed; done from the original Scheme in the Repoſitory of the Royal Society.

A, A. The Branches of the *Vena Portæ* freed from the Liver.

a. The Umbilical Vein.

B. The Splenick Branch.

C, C. The Meſenterick Branches which are continued from the Inteſtines.

b. The Trunk of the *Vena Pancreatica*, which receives Branches alſo from the *Duodenum.*

c, c. The *Vena Gaſtrica dextra Coronaria ſuperior.*

D. The ſuperior Coronary Vein of the Stomach of the Left Side.

E. The inferior Coronary Branch of the Stomach of the Right Side. And,

F. The ſame Coronary Vein of the Left Side removed from their proper Situations; from theſe two laſt are continued the *Vena Epiploica ſuperior Dextra* 1, and the *Siniſtra* 2, with the *Media* 3.

G. The Vein called *Vas breve.*

d. The *Vena Duodeni.*

H. The *Vena Hæmorrhoidalis* ariſing from the *Rectum* and *Anus*, in this Subject emptying it ſelf into the Left Meſenterick Branch; but in other Bodies (and particularly in a Preparation of theſe Veins, which I have now by me) I find this Trunk of the *Hemorrhoid* Veins, ending in the *Ramus ſplenicus.*

The Length of the Trunk of this Hemorrhoid Vein, and its Progreſs under the Inteſtines, renders it liable to be compreſs'd, and its refluent Blood retarded; whence its Branches in the *Inteſtinum rectum* and *Anus*, become diſtended with Blood, and cauſe the *Hæmorrhoides cæcæ* and *Apertæ*; which are frequently attended with *Apoſthumations* in the *Anus* and Parts adjacent; which Diſorders are the more incident, not only becauſe theſe Hemorrhoid Veins (like the reſt of the Branches of the *Vena Portæ*) are without Valves, and the Blood has an aſcending Progreſs in them, as alſo that the long Trunk (H) is not only expoſed to the Compreſſions made by the *Inteſtines* in both Sexes: But particularly the *Uterus* in Women in time of Geſtation, eſpecially near the Birth, ſo compreſſes this Trunk, that it is no Wonder we find Women more afflicted with the Hemorrhoids at that time than any other. Nor are the Iliac Veins and the Lympheduct that accompany them, without being expoſed to the like Incumbrance in Women with Child, whence the Veins of Legs and Thighs become *varicoſe*, and thoſe Limbs are ſo frequently ſwoln, which in a late Inſtance I was acquainted with, when the Intumeſcence proved ſo great, that at length the abdominal Teguments were vaſtly extended; but the Gentlewoman recovered beyond the Expectation of ſome) on the happy Delivery of two large Children.

ARTERIOTOMY, [of Αρτηρια and τομὴ, *Gr. a Cutting*,] is the artificial opening of an Artery for the letting of Blood in an inveterate Head-ach, Madneſs, Falling-Sickneſs, Pain and Inflammation in the Eyes and Ears, and the Section is made in the Forehead, Temples, or behind the Ears; the Manner of it is thus: After the Ligature is made in the Arms or Neck, the Artery is cut juſt as a Vein is, and when the Blood is emitted, you apply a very aſtringent Plaiſter with a Leaden Plate to the Orifice, and then ſwathe it well. *Blanchard.*

ARTHREMBOLUS, [of Ἄρθρον *a Joint*, ἐν *and*, βάλλω *Gr. to caſt*,] the Reduction of a Diſlocation.

ARTHRITIS, [Αρθριτις. *Gr.*] *Morbus articularis*, the *Gout*, is a Pain in the Joints of the Limbs, ſometimes accompanied with a miſerable Contraction of the Nerves, Tendons, Ligaments, and thin Membranes about the Bones, with Swelling and Redneſs, and now and then with hard chalky Concretions. They account it four-fold; *Chyragra*, the Hand-Gout; *Iſchias*, the Gout in or about the Bone connected to the *Os Ilium*, which therefore ſome call the *Hip-Gout*; *Gonagra*, in the Knees; and *Podagra*, in the Feet.

ARTHRITIS *Planetica*, } the wandring Gout,
ARTHRITIS *Vaga*, } which flies or moves from one Limb to another.

ARTHRITICK, or *Arthritical*, [Αρθριτικὸς, *Gr.*] Gouty, diſeaſed in the Joints, *&c.*

ARTHRODIA, [Αρθρωδία, *Gr.*] is the Articulation of one Bone into the ſhallow *Sinus* of another, as the *Radius* receives the *Humerus.*

ARTHROSIS, ['Αρθρωσις, of ἀρθρόω, *Gr. to articulate*,] or *Articulation*; amongſt the Writers of *Anatomy*, is divided into, 1. *Diarthroſis*, or Dearticulation, which is a more looſe Articulation of the Bones, where there is a manifeſt natural Motion of one Bone on the other; in which it differs from the (2.) *Synarthroſis*, or Co-articulation, which is a much cloſer Juncture, and where there is no ſuch natural apparent Motion of one Joint on the other. 3. *Ginglymus*, where each Bone receives into its *Sinus* the *Proceſſus* of the other; as in the Articulation of the *Ulna*, *Tibia*, *Humerus*, and *Oſſa Femorum*.

ARTICLE, [in *Arithmetick*,] is *Ten*, with all other whole Numbers that may be juſtly divided into ten Parts, as 20, 30, 40, *&c.* they are ſometimes called *Decads*, and ſometimes Round Numbers.

ARTICLE, [in *Grammar*,] is a ſmall Word or Particle uſed to decline or vary the Caſes, and to diſtinguiſh the Genders of Nouns and Pronouns, as *hic*, *hæc*, *hoc*, in the *Latin Tongue*.

ARTICULATION, is that Part of Grammar which treateth, firſt, of Sounds and Letters (which are called the Elements of Speech) and then of the Manner of their Combination for the compoſing of Syllables and Words; ſo that he who pronounces his Words clearly and diſtinctly, is ſaid to pronounce them *articulately*. And ſuch Sounds as can be expreſſed by Letters, and which form Words, are called *articulate Sounds*.

Locke juſtly obſerves, that *God* having deſigned Man for a ſociable Creature, made him not only with an Inclination, and under Neceſſity to have Fellowſhip with thoſe of his own Kind, but furniſhed him alſo with Language, which was to be the great Inſtrument and common Tye of Society. Man therefore had by Nature his Organs ſo faſhioned, as to be fit to frame *articulate Sounds*, which we call Words. But this was not enough to produce Language, for *Parrots*, and ſeveral other Birds, will be taught to make *articulate Sounds* diſtinct enough, which yet, by no Means, are capable of Language.

Beſides *articulate Sounds* therefore, it was farther neceſſary, that he ſhould be able to uſe theſe Sounds, as Signs of internal Conceptions; and to make them ſtand as Marks for the Ideas within his own Mind, whereby they might be made known to others, and the Thoughts of Mens Minds be convey'd from one to another.

But neither was this ſufficient to make Words ſo uſeful as they ought to be. It is not enough for the Perfection of Language, that Sounds can be made Signs of Ideas, unleſs thoſe Signs can be ſo made uſe of as to comprehend ſeveral particular Things: For the Multiplication of Words would have perplexed their Uſe, had every particular Thing need of a diſtinct Name to be ſignified by. To remedy this Inconvenience, Language had yet a farther Improvement in the Uſe of General Terms, whereby one Word was made to mark a Multitude of particular Exiſtences: Which advantageous Uſe of Sounds was obtained only by the Difference of the Ideas they were made Signs of. Thoſe Names becoming general, which are made to ſtand for general Ideas, and thoſe remaining particular, where the Ideas they are uſed for are particular.

ARTICULATION, [in *Anatomy*,] is a Conjunction of the Limbs of an animal Body, for the due Performance of Motion: Some make this twofold, *viz.* *Diarthroſis*, which is a more looſe; and *Synarthroſis*, which is a more cloſe Conjunction.

The Term is alſo uſed by the *Botaniſts* for the Joints or Knots that are in ſome *Siliquæ*, as thoſe of the *Ornithopodium*, and in the Roots of the *Polygonatum*, and the Diſtance or Space between Knot and Knot, or Joint and Joint, they call the *Internodium*.

ARTICULATION. This is peculiar to the Bones, and diſtinguiſhed into three Sorts, 1. *Diarthroſis*; 2. *Sycondroſis*; and 3. *Synarthroſis*. Of the firſt there are two Sorts, the *Enarthroſis* or *Arthrodia*, and *Ginglimus*. The firſt is, when a round Head of a Bone is received into a round Cavity of another, ſuch as the Articulation of the *Femur* with the *Iſchium*; and this is called the Ball and Socket. The Property of this Joyning is, that the Parts may move equally to any Side. The *Ginglimus* is deſcribed under that Word; which ſee. The ſecond, *Syncondroſis*, is when the Extremities of two Bones are joyned to one another by Means of an intervening Cartilage; thus the Bodies of the *Vertebræ*, and the Extremities of the Ribs and *Sternum*, are joyned together; where, though the Motion of all is manifeſt, yet that of any two, is hardly diſcernable. The third, *Synarthroſis*, is alſo of two Sorts, the *Sutura*, and *Gomphoſis*. The *Sutura* is when two Bones are mutually indented with one another; the Teeth by which they are indented are of various Figures, ſometimes like the Teeth of a *Saw*, ſometimes broad at the Extremities and narrow at their Baſe, ſometimes the Sides of the Teeth are likewiſe indented, as frequently in the *Sutura Lambdoidalis*. This Sort of *Articulation* is called *Dove-tailing*, and is uſed by *Joyners* in *Drawers*, &c. All the Bones of the *Cranium* and upper Jaw, as alſo the *Epiphyſes* of the Bones, are joyned by this *Articulation*. *Gomphoſis*, is when one Bone is joyned to another, as a Pin or Nail is in a Piece of Wood, and the Teeth only are articulated this Way in their Sockets. To theſe may be added a third Kind of *Synarthroſis*, very different from any of the former, which is, when a Bone has a long and narrow Channel which receives the Edge or Proceſs of another Bone; and thus the *Vomer* is joyned to the *Os ſphænoides* and *ſeptum Narium*: This is called *Ploughing*. Theſe comprehend all the different Articulations of Bones in a human Body, and what other Others mention is to no Purpoſe. The Extremities of all the Bones which are articulated to one another with a manifeſt Motion, are bound together by membranous Ligaments which riſe from the Conjunction of the *Epiphyſes* with the Bone; and paſſing over the Articulation, are inſerted at the ſame Place in the other Bone. Thus they form a Bag, which embraces all that Part of the Extremities of the Bones which play upon one another; and in this Bag is contained a Mucilage for the eaſier Motion of the Joint; this is ſeparated by Glands, which lie in Fat on the Inſide of the Ligaments. Thoſe articulated by *Ginglimus* have the Ligaments much ſtronger than they are either behind or before, that the Protuberances may be kept to play in their Cavities, and to prevent the Bones from ſlipping out of Joint.

ARTIFICIAL *Day*: See *Day*.

ARTIFICIAL *Numbers*, *Secants*, *Sines*, and *Tangents*; See *Logarithmetical Numbers*, *Secants*, *Sines*, and *Tangents*.

ARTIFICIAL *Lines*, on any Sector or Scale, are Lines ſo contrived as to repreſent the Logarithmetical Sines and Tangents, which, by the Help of the Line of Numbers, will ſolve all Queſtions in Trigonometry, Navigation, *&c.* tolerably exact.

ARTILLERY, [*Artillerie*, *F.*] is all Sorts of great Fire-Arms, with their Appurtenances; with Cannons of all Sorts, Mortars, Muſquets, Carabins, *&c.*

The Liberal ARTS, are thoſe which are noble and ingenuous, and worthy to be cultivated, without any Regard being had to Lucre or Gain ; theſe are *Architecture*, *Grammar*, *Military Art*, *Muſick*, *Navigation*, *Painting*, *Poetry*, &c.

Mechanick ARTS, are ſuch wherein the Hand and Body are more concerned than the Mind, and which are generally cultivated for the Sake of the Gain or Profit that accrues from them, ſuch as Trades, *Weaving*, *Turnery*, *Maſonry*, &c.

ARYTÆNOIDES, or *Gutturales*, are two Cartilages, which with others make up the Top of the *Larynx* ; and theſe are ſo called, becauſe when their Proceſſes are joined together, they repreſent the Mouth of an *Ewer*, (*Gutturium*) or the indented Lip of a Cup or Veſſel.

ARYTÆNOIDEUS *Minor*, [Ἀρυταινοειδὴς, of *ἀρύω to drink*, and εἶδος, *Gr. Shape*,] is a Muſcle which runs on the Surface of the *Arytænoidus major*, ariſing from that Part of one of the *Cartilagines Arytænoidæi*, next the *Cricoides* on one Side, and terminating in that Part of the other *Arytenoidal Cartilage*, which is fartheſt from the *Cricoides* on the other Side. Its Uſe is to aſſiſt the other Muſcle of this Name in its Action, which is much ſtrengthened by this manifeſt Decuſſation of the Fibres.

ARYTÆNOIDEUS, is the ſmalleſt Muſcle belonging to the *Larynx* : It is, in the Opinion of ſome, double ; but has always, ſays Mr. *Cowper*, appeared to us ſingle. It ariſes from the external Part of one of the *Arytenoidal Cartilages*, and running tranſverſly, is inſerted to the other. This pulls the *Arytenoidal Cartilages* nearer each other, and ſhuts the *Rimula* adequately, by forcing down the *Epiglottis*, which quite cloſes the *Glottis*, ſo that no Air can enter.

ASAPHATUM, is a Kind of *Impetigo*, *Serpigo*, or running Itch.

ASAPHY, is a Lowneſs of the Voice, proceeding from an ill Conſtitution, or Contemporation of the Organs of Speech.

ASBESTINE *Paper* or *Cloth*, is ſuch as will burn in the Fire, be purified by it, and yet not conſume. 'Tis made of the *Asbeſtos* or *Lapis Amianthus*, and is by ſome called *Linum vivum.*

ASCARIS, or *Aſcarides*, [Ἀσκαρίδης, *Gr.*] are little Worms which breed in the *Inteſtinum rectum*, and tickle and trouble it.

ASCENDANT, is that Part of the Heavens which aſcends, or is coming up above the Horizon in the *Eaſt*.

ASCENDANT, [in *Aſtrology*,] that Degree of the Equator, or that Part of the Heaven, which riſes or is coming above the Horizon in the *Eaſt*, when any Perſon is born, called alſo the Angle of the firſt Houſe in a Scheme or an Horoſcope.

ASCENDANT, [in *Architecture*,] an Ornament in *Maſonry* and *Joyner*'s Work, which borders the three Sides of Doors, Windows, and Chimneys. It is different according to the ſeveral Orders of Architecture, and which conſiſts of three Parts ; the Top, which is called the *Traverſe*, and the two Sides, which are called *Aſcendants*.

ASCENDING, [in *Aſtronomy*,] is underſtood of thoſe Stars, or Degrees of the Heavens, *&c.* which are riſing above the Horizon in any Parallel of the Equator.

ASCENDING *Latitude*, is the Latitude of a Planet when going towards the Poles. See *Latitude*.

ASCENDING *Node*, is that Point of a Planet's Orbit, wherein it paſſes the Ecliptick to proceed to the Northward. See *Orbit*, *Planet*.

ASCENDING *Signs*, [*Aſtrology*,] are thoſe Signs which are upon the Aſcent or Riſe, from the *Nadir* to the *Zenith*.

ASCENSION, is the riſing of the *Sun* or *Star*, or of any Part of the Equinoctial with it, above the Horizon. *Deſcenſion* is the ſetting of the ſame. Theſe *Aſcenſions* and *Deſcenſions* are either *Right* or *Oblique* ; which ſee.

Right ASCENSION, [*Aſtronomy*,] is that Degree of the Equator, reckoned from the Beginning of *Aries*, which riſes either with the Sign, Sun, or Star, on the Horizon, of a right Sphere, or it is that Degree and Minute of the Equinoctial that comes to the Meridian of the Sun or Star, or with any Point of the Heavens.

Oblique ASCENSION, [*Aſtron.*] is that Degree and Minute of the Equator, which riſeth with the Centre of the Sun or Star, or with any Point of the Heavens on the Point of an oblique Sphere.

ASCENSIONAL *Difference*, [in *Aſtronomy*,] is the Difference between the Right and Oblique Aſcenſion or Deſcenſion ; or it is the Space of Time the Sun riſeth or ſetteth before or after Six of the Clock.

To find the *Aſcenſional Difference* Trigonometrically, having the Latitude of the Place, and the *Sun*'s Declination given,

Say, As the Co-Tangent of the Latitude : Is to the Tangent of the Sun's Declination : : So is the Radius : To the Sine of the Aſcenſional Difference.

Example. Suppoſe the Latitude be 51°. 30′. and the Sun's Declination be 2°. 00.

Then th the Ar. Co. of
the Ca-Tangent of } 51°. 30′. - - 0,099395
Add the Tangent of - - 9°. 00′ - - 9,199712

Sum is the Sine of 11°. 29 = 9,299107

Which is the Aſcenſional Difference required ; and being reduced into Time, by allowing four Minutes of an Hour for every Degree, it will be 44′. 29″.

ASCENT of *Fluids*, is particularly underſtood of their riſing above their own Level between the Surfaces of nearly contiguous Bodies, or in ſlender capillary Glaſs Tubes, or in Veſſels filled with Sand, Aſhes, or the like porous Subſtance. See *Fluid*.

This Effect happens as well *in vacuo* as in the open Air, and in crooked as well as ſtrait Tubes. Some Liquors, as Spirit of Wine, and Oil of Turpentine, aſcend ſwifter than others, and ſome riſe after a different Manner from others. Mercury does not aſcend at all, but rather ſubſides. See *Capillary Tubes*.

As to Planes. Two ſmooth poliſh'd Plates of Glaſs, Metal, Stone, or other Matter, being ſo diſpoſed as to be almoſt contiguous, have the Effect of ſeveral capillary Tubes, and the Fluid riſes in them accordingly ; the like may be ſaid of a Veſſel filled with Sand, *&c.* the divers little Interſtices whereof form, as it were, a Kind of capillary Tubes ; ſo that the ſame Principle accounts for the Appearance in them all. And to the ſame may probably be aſcribed the Aſcent of the Sap in Vegetables. See *Vegetable* and *Vegetation*.

Sir *Iſaac Newton*, in his *Opticks*, *p.* 367. ſays, ' That if a large Pipe of Glaſs be filled with ſifted ' Aſhes well preſs'd together, and one End dipped ' into ſtagnant Water, the Fluid will aſcend ſlowly

‘ in the Aſhes, ſo as in the Space of a Week or Fortnight to reach the Height of 30 or 40 Inches above the ſtagnant Water. This *Aſcent* is wholly owing to the Action of thoſe Particles of the Aſhes which are upon the Surface of the elevated Water; thoſe within the Water attracting as much downwards as upwards: It follows, that the Action of ſuch Particles is very ſtrong; though being leſs denſe and cloſe than thoſe of Glaſs, their Action is not equal to that of Glaſs, which keeps Quickſilver ſuſpended to the Height of 60 or 70 Inches, and therefore acts with a Force which would keep Water ſuſpended to the Height of above ſixty Foot. By the ſame Principle, a Sponge ſucks in Water, and the Glands in the Bodies of Animals, according to their ſeveral Natures and Diſpoſitions, imbibe various Juices from the Blood.’

If a Drop of Oil, Water, or other Fluid, be laid on a Glaſs Plane perpendicular to the Horizon, ſo as to ſtand without breaking or running off, and another Plane inclined to the former, ſo as to meet at Top, be brought to touch the Drop, then will the Drop break, and aſcend toward the touching End of the Planes; and it will aſcend the faſter in Proportion as it is higher, by Reaſon the Diſtance between the Planes is conſtantly diminiſhing. After the ſame Manner the Drop may be brought to any Part of the Planes, either upward or downward, or ſideways, by altering the Angle of Inclination.

Laſtly, If the ſame perpendicular Planes be ſo placed, as that two of their Sides meet and form a ſmall Angle, the other two being only kept a-part by the Interpoſition of ſome thin Body; and thus immerged in a Fluid tinged with ſome Colour; the Fluid will aſcend between the Planes, and this the higheſt where the Planes are neareſt, ſo as to form a curve Line, which is found to be a juſt Hyperbola, one of the Aſymptotes whereof is the Line of the Fluid, the other being a Line drawn along the touching Sides. The Phyſical Cauſe in all this *Phœnomena* is the ſame Power of Attraction. See *Attraction.*

ASCII, [’Ασκιοὶ, of *α priv.* and *σκία*, *Gr. a Shadow,*] are the Inhabitants of the *Torrid Zone*, which twice a Year have the Sun (at Noon) in their Zenith, and conſequently, then their Bodies caſt no Shadow; whence comes the Name of *Aſcii.*

ASCITES, [*Ασκίτης*, *Gr.*] is a Dropſy or Swelling of the Abdomen, and conſequently of the *Scrotum*, Thighs and Feet, proceeding from a ſerous, and ſometimes lymphatick or chylous Matter, like the waſhing of Fleſh, collected in the Cavity of thoſe Parts.

ASCITICK, [’*Ασκιτικὸς*, *Gr.*] is he that is affected with the *Aſcites.*

ASCLEPIAD, a *Greek* or *Latin* Verſe of four Feet, containing a *Spondee*, a *Choriambus*, and two *Dactyles*; as,

Sublimi feriam ſidera vertice.

ASH-FIRE, the mildeſt Fire uſed in Chymical Operations, when the Veſſel containing the Matter to be heated is covered underneath and on all Sides with Aſhes, Sand, or the Filings of Iron.

ASHLAR, is the Workmens Term for common or Free-Stone, as it comes out of the Quarry.

ASHLERING, [with *Builders*,] a Name they give to Quartering they tack to in Garrets, in Height about two Feet and a half, or three Feet, perpendicular to the Floor, up to the Inſide of the Roof.

ASPARAGUS, [in *Botanicks*,] ſignifies the firſt *Germen*, *Sprout*, or *Shoot* of a Plant; which is either edible by it ſelf, or boiled in Broth: It comes out before the Leaves are unfolded. And hence, (*i. e. a* *σϖείρω*) the famous Plant of this Name receives its Denomination.

ASPECT, [*Aſpectus*, *L.*] the Air of one's Countenance.

ASPECT, [in *Aſtrology*,] is when two Planets are joined with or behold each other, or when they are placed at ſuch a Diſtance in the Zodiack, that they (as 'tis ſaid) mutually help or afflict one another, or have their Virtues or Influences increaſed or diminiſhed.

ASPECT, [a Term in *Aſtronomy*,] ſignifying the Situation of the Stars and Planets, in Reſpect of one another: Of theſe they uſually reckon five.

1. The *Sextile*, when two Stars or Planets are 60 *degr.* from one another.
2. *Quartile*, when they are 90 *deg.* diſtant.
3. *Trine*, when they are diſtant 120 *deg.*
4. *Oppoſition*, when they are 180 diſtant.
5. *Conjunction*, when they are both in the ſame Degree.

Kepler added eight new *Aſpects* more, as the *Demi-ſextile* of 30°. the *Decile* of 36°. the *Octile* of 45°. the *Quintile* of 72°. the *Tredecile* of 108°. the *Seſquartile* of 135°. the *Biquintile* of 144°. and the *Quincunx* of 150°.

How the Diſtance is reckoned, and on what Circle; ſee the Word *Secondary Circles.*

Partile ASPECTS, [*Aſtrology*,] is when Planets are diſtant juſt ſuch a Number of Degrees, as 30, 36, 45, *&c.*

Platick ASPECTS, [*Aſtrology*,] are when the Planets do not regard each other from theſe very Degrees, but the one exceeds as much as the other wants.

Double ASPECT, is a Term in *Painting*, uſed for a ſingle Figure repreſenting two or more different Objects; which is cauſed either by a Change of the Poſition of the Eye, or by angular Glaſſes, *&c.*

ASPERA *Arteria*, or *Trachea*, is an oblong Pipe conſiſting of various Cartilages and Membranes, which begin at the Throat, or lower Part of the Jaws, lies upon the Gullet, deſcends into the Lungs, and is diſperſed by manifold Ramifications or Branches through their whole Subſtance: The upper Part is called *Larynx*, and the lower *Bronchus*, to which *Malpighius* adds a third, or loweſt, called by him *Veſicular*: It is ſubſervient to Speech and Reſpiration.

That Part of the *Aſpera Arteria* which is called the *Bronchus*, contains all of it but the *Larynx*, being the Body of the Pipe as well before as after its Inſertion into the Lungs, all the Cartilages of this *Bronchus* are like the loweſt of the *Larynx*, to which the uppermoſt of the *Bronchus* adheres: Theſe Cartilages are ſeated one below another at equal Diſtances, and kept in their Places by both the Membranes of the *Trachea*, which fill up their Interſtices, and tie them one to another like Ligaments. Yet theſe Rings have not their Circle entire, but on the Backſide of the *Bronchus* next the Gullet, that they might give Way to the Meat in ſwallowing, they paſs into a Membrane, ſo that they are in Figure like the Letter C. But this Interſtice in their Circle, which moſt Anatomiſts affirm to be membranous, *Caſp. Bartholin* (after his Father) ſays, is rather a carnous Fibre that runs from one Side or End of the Cartilage a-croſs to the other, which, in Expiration, (eſpecially violent) contracting themſelves, draw the Ends of the Cartilage towards one another on each Side, and thereby ſtraiten the Pipe of the *Trachea*.

And tho' the Cartilages, ſo far as they are contiguous to the Gullet, (being about 20 in Number, are thus ſemilunar, as it were, yet thoſe of the Branches of the *Bronchus* within the Lungs, have no Interſtice in their Circumference, being all cartilaginous, though not all of a circular Figure, but ſome Four-ſquare, others Triangular, &c. as *Diemerbroeck* obſerves, the inner Membrane is plentifully beſet with military Glands, out of which a good Part of that mucous Matter that bedaubs its Inſide iſſues, for the lubricating of it. The outer Membrane helps to connect the Cartilages the more firmly one to another, and the whole *Trachea* to the neighbouring Parts, that it may more ſafely and firmly deſcend into the *Thorax*. This is much thinner than the other; for the inner (according to Dr. *Wallis*) has two Rows of muſcular Fibres, the outer ſtrait, the inner oblique; the firſt by their Contraction ſhorten the *Trachea*, the latter ſtraiten it; ſo that he thinks they aſſiſt Expiration, eſpecially when it is violent, as Coughing, Hawking, or the like. Yet he ſays, this inner Membrane has two others growing upon it, as it were, one glandulous, and and another vaſcular. Thro' this latter do the Blood Veſſels and Nerves every where run; and the Glands placed in the former, receive and keep all the ſuperfluous Moiſture or *Lympha* depoſited by the Arteries, which the Veins do not imbibe, till they can remand it by the Lympheducts (which ſpring from them) or if it be over-plentiful, ſo that the Lympheducts cannot receive it at all, then it iſſues both out of theſe Glands, and out of the Arteries into the Cavity of the Wind-pipe, and cauſes a Catarrh. But the Inſide of this Membrane is naturally moiſt, being beſmeared with a fattiſh and mucous Humour, to hinder its drying, and to make the Voice ſmoother; ſo that when this Humour is fretted off in Catarrhs, or the Inſide of this Membrane becomes rough from any Cauſe, the Voice becomes hoarſe; and when it is dried by too much Heat, as in Fevers, it becomes ſqueaking.

The *Aſpera Arteria* has Veins from the external Jugulars, Arteries from the *Carotides*, and from the *Arteria Bronchialis* (firſt found out by *Frederick Ruyſch*) which ſprings from the Backſide of the deſcending Trunk of the *Aorta*, a little above the lower Intercoſtals. Nerves it receives from the recurring Branches of the *Par Vagum*, which run moſtly along its inner Membrane, whence it becomes ſo exquiſitely ſenſible.

When it is deſcended as low as the fourth *Vertebra* of the *Thorax*, it is divided into two Trunks, whereof one goes into the right Lobe of the Lungs, the other into the left, and each preſently is again divided into two, and thoſe into others, till at laſt they end in very ſmall Branches, which are diſperſed among the like Branches of the Pulmonary Artery and Vein, and end in and are continued with the little Bladders that make up the greateſt Part of the Bulk of the Lungs.

ASPERIFOLIÆ (*Plantæ*,) is one of the Diviſions or Kinds of Plants: See *Plants*, *N.* 11.

In this Kind of Plants, the Leaves ſtand alternately, or without any certain Order on the Stalks: The Flowers are *monopetalous*, but having the Margin cut into five Diviſions, ſometimes deep, ſometimes ſhallow; and the upper Spike or Top of the Plant is often curved back ſomething like a Scorpion's Tail. They are called *Aſperifoliæ*, becauſe they are uſually *rough leafed*, but they are not always ſo. After each Flower of this Kind of Plants, there uſually ſucceed four Seeds: There being only the *Cerinthe* reckoned by Mr. *Ray* to belong to this Genus, which hath leſs than four Seeds at the Root of each Flower, but that hath but two.

The *Herbæ Aſperifoliæ* are, the *Pulmonaria maculoſa*, *Cynogloſſa*, *Borago*, *Bugloſſa*, *Anchuſa*, *Echium*, *Linum Umbilicatum*, *Heliotropium majus*, *Aparine major*, *Conſolida major*, *Lithoſpermum*, *Echium Scorpoides* and *Cerinthe*.

ASPERITY, [*Aſperitas*, *L.*] is the Inequality or Roughneſs of the Surface of any Body, whereby ſome Parts of it do ſo ſtick out above the reſt, as to hinder one's Hand, &c. from paſſing over it eaſily and freely.

ASPHYXIA, ['Ἀσφυξία, *Gr.*] or a Ceſſation of the Pulſe of the whole Body, it is the higheſt Degree of Swooning, and next to Death.

ASPIRATION, or the pronouncing of any Syllable or Word ſtrongly, with a good deal of Breath and ſome Vehemency; as we do thoſe Words which have the Letter *H* before them, as *have*, *hear*, *heat*, &c. whereas they are ſounded much ſofter and eaſier without the *H*; as *ear*, *eat*, &c.

ASSART, [of *aſſartir*, *Fr. to make plain*,] a Term in *Law*, ſignifying an Offence committed in the Foreſt, by plucking up the Woods by the Roots: Alſo to make Glades in a Wood, to grub up or clear a Ground of Buſhes and Shrubs, &c. or to lop off the Boughs of a Tree.

ASSATION, is a Term in *Pharmacy*, uſed for a peculiar Kind of Decoction or Boiling of Plants, &c. in their own Juice.

ASSAULT, [*Aſſaut*, *F.*] in *Law*, ſignifies a violent Kind of Injury offered to a Man's Perſon, of a more large Extent than Battery; for it may be committed only by offering to give a Blow.

ASSAULT, [in the Art of *War*,] is taken alſo for a general Attack made upon the Fortreſs to get it by main Force, without defending themſelves in the Attack by any Works: The Words are, *to give an Aſſault* to ſuch a Place; *to be commanded to the Aſſault*; *to ſtand an Aſſault*; *to ſecond an Aſſault*; *to repulſe an Aſſault*; *to carry by Aſſault*, &c. While an Aſſault laſts, and both Parties are mixed, there is no Fear of Cannon on either Side, for they are afraid of deſtroying their own Men thereby.

ASSEMBLEE, [in *Heraldry*,] a Dovetail or more to hold the two Parts of the Eſcutcheon together, where the Partition Line is, being counter-charged, is ſome of the Metal and ſome of the Colour of the Eſcutcheon.

ASSEMBLY, [in the *Military Art*,] is the ſecond Beat of a Drum before a March; on hearing this, the Soldiers ſtrike their Tents, and roll them up; and then ſtand to their Arms. The third Beating is called the *March*, as the firſt is called the *General*.

ASSETS *entre mains*, [in *Law*,] is where a Man dies indebted, leaving to his Executors ſufficient wherewith to diſcharge his Debts and Legacies.

Real ASSETS, are where a Man dies poſſeſſed of *Fee Simple*.

Perſonal ASSETS, are where a Man dies poſſeſſed of any perſonal Eſtate.

ASSETS *per Deſcent*, [in *Law*,] are where a Man enters into Bonds, and dies poſſeſſed of Lands in *Fee Simple*, which deſcend to his Heirs, and therefore are chargeable as Aſſets in his Hands. *L.*

ASSEWIARE, ſignifies to draw or drain out Water from a marſhy Ground.

ASSIGN, [a *Law Term*,] is he that is appointed or deputed by another to do any Act, or perform any Buſineſs, or enjoy any Commodity: and it is either in *Deed*, or in *Law*.

ASSIGNEE in *Deed*, is he that is appointed by the Perſon himſelf.

ASSIGNEE in *Law*, is he whom the Law ſo makes, without any Appointment of the Perſon.

ASSIGNMENT, the Act of Aſſignment, or ſetting over the Intereſt of any thing to another, as *the Aſſignment of a Leaſe*, &c.

ASSIGNMENT *of Dower*, [in *Law*,] is the ſetting out the Marriage Portion or Dower of a Woman by the Heir, according to the Eſtabliſhment before made.

ASSIMILATION, is a Term in *Anatomy*, by which they expreſs the Change that is made either of Chyle into Blood, or of the nutritious Juice into the Subſtance of an animal Body. Thus the modern *Anatomiſts* ſay, *Sanguification* is not performed by the Liver only, as the Ancients ſuppoſed, but by a gradual changing of the Chyle into Blood by frequent Circulations, and the Manner of this Change they call *Aſſimilation*.

ASSISA *cadere*, [in *Law*,] ſignifies to be nonſuited.

ASSISA *Nocumenti*, an Aſſize of Nuſance.

ASSISA *Continuanda*, is a Writ directed to the Juſtices aſſigned, to take an Aſſize for the Continuance of a Cauſe, where certain Records alledged cannot in Time be procured by the Party that would uſe it.

ASSISA *Proroganda*, is a Writ directed to the Juſtices of Aſſize for the Stay of Proceedings, by Reaſon of the King's Buſineſs, wherein the Party is employed.

ASSISA *magna*, was a more ſolemn Trial by a Jury of twelve or more Knights, to give their Verdict in a Cauſe proſecuted *per Breve de Recto*, i. e. where the Diſpute lies not about the bare Poſſeſſion, but of the *Right* and *Property*; in this diſtinguiſhed from the *Aſſiſa parva*, or *minor*, where the Queſtion is only of Poſſeſſion, in which the Jury were twelve ordinary Legal or Freemen return'd by the Sheriff.

ASSISÆ *Judicium*, is the Judgment of the Court given againſt the Plaintiff or Defendant for Default.

ASSISE *de mort d'Anceſtor*; ſee *Coſinage*.

ASSISE *de utrum*, lieth for a Parſon againſt a Layman, or a Layman againſt a Parſon, for Land or Tenement doubtful, whether it be Lay-Fee, or Free-Alms.

ASSIZE, [in *Law*,] properly ſignifies a Writ that lies where any Man is put out of his Lands, Tenements, or of any Profit to be taken in a certain Place, and ſo diſſeiſed of his Freehold. In an *Aſſize* it is needful always that there be one Diſſeiſor, and one Tenant, or otherwiſe the Writ ſhall abate.

There is another *Aſſize* called *Aſſize of freſh Force*, and lies where a Man is diſſeiſed of Tenements which are deviſable; as in *London*, or other Boroughs that are Franchiſes: For there the Tenant ſhall come into the Court of the Town or Borough, and enter his Plaint, and accordingly ſhall have a Writ directed to the Mayor or Bailiffs, *&c.* and thereupon ſhall paſs a Jury in Manner *of Aſſize of Novel Diſſeiſin*; and in Caſe the Officer delay Execution, the Plaintiff ſhall have another Writ of Execution, then a *Sicut alias*, and after that a *Pluries*, *&c.* And from Things of this Nature being done by the Judges in their Circuits; when at any Place they ſit to do Juſtice by Commiſſion, that Court or Meeting is called the *Aſſizes*.

But beſides this, the Judges of the *Aſſizes* have ſeveral other Commiſſions; as 1. A Commiſſion of *Oyer* and *Terminer*, directed to them, and to many others of the beſt Account in their Circuits; but here the Judges are of the *Quorum*, ſo as without them there can be no Proceeding: By this Commiſſion they enquire into and puniſh Murders, Treaſons, Felonies, *&c.* 2. They have a Commiſſion of Goal Delivery; this is directed only to themſelves, and the Clerk of the Aſſize Aſſociate; and by this Commiſſion they deal with all Priſoners in Goal, for whatever Offences there committed. 3. They have alſo a Commiſſion of *Niſi Prius*, directed to the Judges themſelves and the Clerk of the Aſſize, by which they are commiſſionated to take *Niſi Prius*, &c. 4. They have alſo a Commiſſion of the Peace, in which all the Juſtices of the Peace of the ſeveral Circuits are obliged to aſſiſt them; for Default of which they are fineable at the Diſcretion of the Judges.

ASSIZE *de darraign Preſentment*: See *Quare impedit*.

ASSIZE *of Novel Diſſeiſin*, lies where a Tenant in Fee-ſimple, Fee-tail, or for Term of Life, is lately diſſeiſed of his Lands or Tenements, or elſe of a Rent-ſervice, Rent-ſec, or Rent-charge of Common, of Paſture, of an Office, *&c.*

ASSIZE *of the Foreſt*, is a Statute or Condition touching Orders to be obſerved in the King's Foreſt.

ASSIZE *of Bread and Beer*, is the Power a Magiſtrate has of aſſizing or adjuſting Weights and Meaſures.

ASSOCIATION, [in *Law*,] is a Patent ſent by the King, either of his own Motion, or at the Suit of the Party Plaintiff to the Juſtices of Aſſize, to have other Perſons aſſociated to them to take the Aſſize; and upon this Patent of the Aſſociation, the King will ſend his Writ to the Juſtices of the Aſſize, by it commanding them to admit them that are ſo ſent.

ASSODES *Febris*, is a Kind of burning Fever, in which the ſick Perſon inceſſantly tumbles and toſſes, being exceeding reſtleſs, and ſubject to Sickneſs at the Stomach, and Vomiting, by Reaſon that the Diſtemper uſually ariſes from the Vexation of the Stomach by ſharp and cholerick Humours, biting the Orifice or Coat thereof. *Blanchard*.

ASSOYLE, [of *aſſoudre*, *F.* *abſolvere*, *L.*] a *Law Term*, ſignifies to deliver or diſcharge a Man of an Excommunication.

ASSUMPSIT, [in *Law*,] or *Nude Contract*, is a voluntary Promiſe made by Word, by which a Man aſſumes and takes upon him to perform, or pay any thing to another; or a Promiſe may ariſe in *Law*, as upon the Sale of Goods, *&c.*

ASSUMPTION, [in *Logick*,] is the minor or ſecond Propoſition in a *Categorical Syllogiſm*.

ASSUMPTIVE *Arms*, [in *Heraldry*,] are ſuch as a Man hath a Right to aſſume to himſelf by virtue of ſome Action; as if a Man, who is no Gentleman by Blood, and has no Coat of Arms, ſhall in War take a Lord, *&c.* Priſoner, he is intitled to bear the Shield of ſuch Priſoner, and to enjoy it to him and his Heirs.

ASTERISK, [of Ἀστερίσκος, of Ἀστὴρ, *Gr. a Star*,] is a ſmall Star ſet over any Word or Sentence, to make it the more conſpicuous, or taken Notice of by the Reader.

ASTERISM, [Ἀστερισμὸς, *Gr.*] the ſame with *Conſtellation* ; or a Collection of many Stars into one Claſs or Syſtem, which is uſually on the Globe repreſented by ſome one particular Image or Figure, to diſtinguiſh the Stars that compoſe this Conſtellation from thoſe of others.

ASTHMA, [Ἆσθμα, *Gr.*] or *Phthiſick*, is a Difficulty of Breathing, proceeding from the ill Affection of the Subſtance of the Lungs, and the intercoſtical Muſcles ſerving to Reſpiration.

ASTRAGAL, (Ἀστράγαλος, *Gr.*) in *Architecture*, is by the *French* called the *Talon*, by the *Italians Tondino*, and is a Kind of half *Tore*, ſometimes wrought, in the richer Orders, like a Kind of overcaſt Hem or Edge to the larger *Tore* ; which frequently is placed between, as in the *Ionick Baſe*, with two *Scotia's* or *Trochiles* ; and ſometimes, but rarely, juſt about the Plinth of the Baſe. Sometimes it is taken for the Collar or Cincture next the *Hypotrachelium* and Diminution of a Pillar lifted on both Edges; and it runs alſo round under the *Echinus* of the *Ionick*. We find it alſo ſometimes dividing the *Faſcia* of the *Corinthian Architrave*, where it is wrought in Chaplets, and Beads or Berries; and ſometimes 'tis uſed both above and below the *Liſts*, and joining immediately to the Square or Die of a Pedeſtal, where the *Stylobata* is introduced. Freart's *Parallel of Architect.*

ASTRAGAL, (in *Gunnery*,) is the Cornice Ring of a Piece of Ordnance.

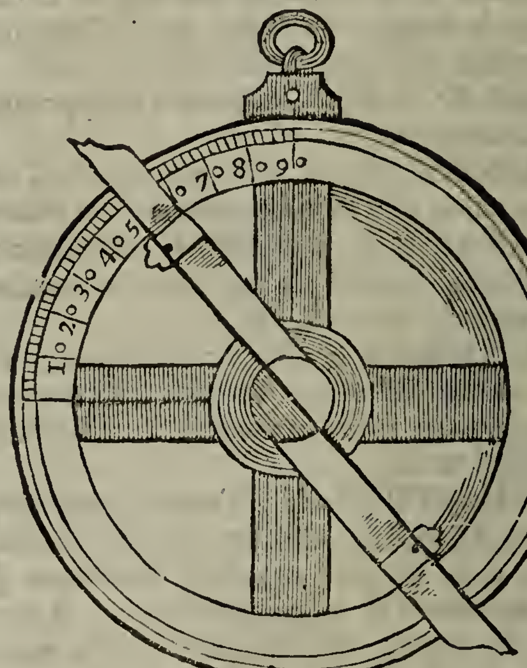
ASTRAGALUS, (Ἀστράγαλος, *Gr.*) the Huckle Bone ; alſo a Bone of the Heel, having a Convex Head, articulated with two Foſſils of the Legs by the *Ginglimus*.

ASTRICTORIA, Medicines that are of an aſtringent or binding Quality.

ASTROLABE, (Ἀστρολάβιον, of ἀστὴρ *a Star*, and λαβεῖν, *Gr. to take.*) This *Planiſphere*, conſidered as a Projection of the Sphere, is of two Kinds ; the firſt is a Projection of the Sphere on the Plane of the Equinoctial in the Stereographick Way, the Eye being ſuppoſed to be placed in the Pole of the World. The other *Aſtrolabe* is of *Gemma Friſius*, which ſuppoſes the Eye in the Point of the Interjection of the Equator and Horizon, projecting the Sphere on the Plane of the oppoſite Meridian.

ASTROLABE, is a Mathematical Inſtrument ſerving to take the Height of the Sun or Stars. It conſiſts of an entire Circle, whoſe Limb (or what Part of it is neceſſary) is divided into Degrees and Decimal Parts of a Degree, with a moveable Ruler or Label which turns upon the Centre, and carries two Sights. At the Zenith is a Ring to hang it by in Time of Obſervation, and then you need only turn it ſo to the Sun, that the Rays may paſs freely through both the Sights, and the Edge of the Label cuts the Altitude in the Limb. This *Aſtrolabe*, though now not ſo much in Uſe at Sea, yet if well made, graduated and poiſed, and of a great Thickneſs and Weight, that it may hang the ſteadier, it may be a very ſerviceable Inſtrument, eſpecially between the Tropicks, where the Sun comes near the Zenith ; and in calm Weather. There are alſo ſome Projections of the Sphere which are called by this Name, as that of *Gemma Friſius* and *Stoffler*.

The common Sea Aſtrolabe.



ASTROLOGY, (Ἀστρολογία, of ἀστὴρ *a Star*, and λόγος, *Gr. Speech*,) is an Art which pretends to foretel future Things from the Motion of the Heavenly Bodies, and their Aſpects to one another ; as alſo from ſome imaginary Qualities, which the fooliſh Admirers of this Cheat will have to be in the Stars, as the Cauſes of great ſublunary Effects; though they have no tolerable Grounds to prove that there are any ſuch things.

ASTRONOMICAL *Calendar*, is an Inſtrument engraved on Copper Plates, printed on Paper, and paſted on Board, with a Braſs Slider, which carries a Hair, and ſhews by Inſpection, the Sun's Meridian, Altitude, Right Aſcenſion, Amplitude, Declination, Time of its Riſing and Setting, *&c.* to greater Nicety than the largeſt Globes now made.

ASTRONOMICAL *Numbers* : See *Sexageſimal Fractions*.

ASTRONOMICAL *Place of a Star or Planet*, is its Longitude or Place in the Ecliptick reckoned from the Beginning of *Aries*, *in Conſequentia*, or according to the natural Order of the Signs.

ASTRONOMICAL *Houſes*, are ſuch as are reckoned from the Noon or Mid-day, to the Noon or Midnight of another.

ASTRONOMICAL *Hours*, are ſuch as are accounted from the Noon of one natural Day, or, as ſome will have it, from Midnight, to the Noon or Midnight of the next natural Day.

ASTRONOMICAL *Quadrant*, is an Inſtrument curiouſly framed, and the Degrees exactly and minutely divided by the Help of a Screw on the Edge of the Limb, fitted with Teleſcopes, and either apply'd to a Wall in the Meridian, or on a ſtrong Axis or Pedeſtal, with two Semi-circles placed at Right-angles on two endleſs Screws, which readily direct or guide the Inſtrument to take Obſervations of the *Sun*, *Moon*, or *Stars*.

ASTRONOMICALS, *i. e. Aſtronomical Numbers*, being ſexageſimal Fractions, ſo named, becauſe formerly they were wholly uſed in Aſtronomical Calculations.

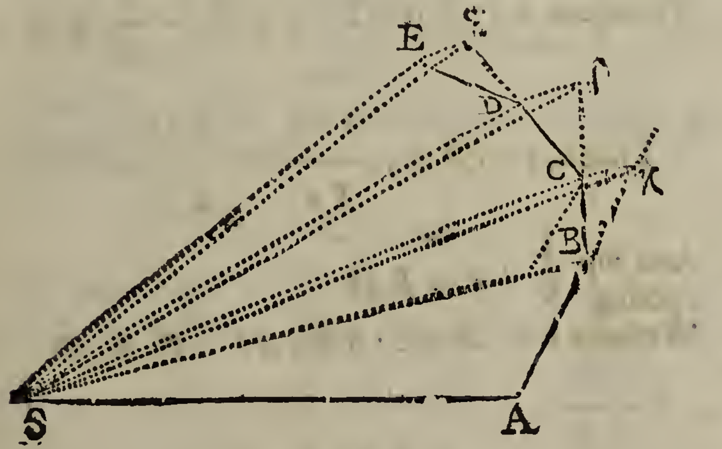
ASTRONOMY, is a Mathematical Science, teaching the Knowledge of the Stars or Heavenly Bodies, and their Magnitudes, Diſtances, Eclipſes, Order, and Motions: By ſome 'tis taken in ſo large a Senſe, as to contain in it alſo the Doctrine of the *Mundane Syſtem*, the Laws of the *Planetary Motions*, *&c.* which others reckon as a Part of *Phyſicks*, or *Natural Philoſophy.*

ASTRONOMY. In order to prepare the Way for the right underſtanding of this noble Science, as it now ſtands in the Writings of the modern Aſtronomers, who have revived and demonſtrated the *ancient Pythagorean Syſtem of the World:* And beſides thoſe neceſſary *Præcognita* of the Doctrine of the Sphere, its Projection *in plano*, and the ſpherick Trigonometry (which every one ought to know that will purſue this Study; I ſhall here (from Mr. *Hayes*'s *Fluxions*, p. 291, *&c.*) give you ſuch Phyſical and Mechanical Propoſitions, as will qualify you to obtain a ſufficient Knowledge of the Doctrine contained in the preſent Books of Aſtronomy.

PROP. I.

The Area's which Bodies (ſuppoſe any Planets or Comets) revolving about an immoveable Centre, (as ſuppoſe the Sun *in S) deſcribe by the Rays drawn to the ſame, are proportional to the Times of Deſcription, and are all in the ſame immoveable Plain.*

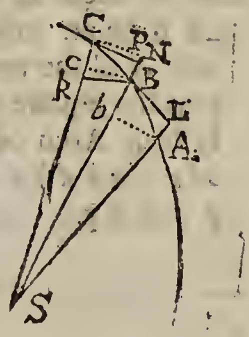
Let the Time be divided into equal Parts, and ſuppoſe in one of them, a Body deſcribes the Space AB (by a Power which it has to move in the Right Line Ax from A towards x) in the next Moment of Time, if nothing hindred, it would move from B to x, deſcribing the Line Bx equal to AB, ſo that drawing the Rays AS, BS, xS to the immoveable Centre S, the Areas ASB and BSx deſcribed, would be equal: But when the Body comes to B, let a Force in S attract the ſame, and by one ſingle but ſtrong Impulſe, make the Body deviate from the Right-line Bx, and move in the Right-line BC; draw xC parallel to BS, interſecting BC in C, then at the End of the ſecond Moment of Time, the Body will be found in C, in the ſame Plain with the Triangle ASB; join SC and the Triangle SBC, becauſe of the Parallels SB and Cx, will be equal to the Triangle SBx, and conſequently it will be alſo equal to the Triangle SAB: In like Manner, if the central Force (or *Vis centripeta*) act ſucceſſively in C, D, *&c.* and make the Body in ſucceſſive Moments of Time deſcribe the Lines CD, DE, *&c.* they will be in the ſame Plain, and the Triangle SCD will be equal to the Triangle SBC, and SDE will be equal to $SCD = SBC$. Whence it is manifeſt, that the Body revolving about an immoveable Centre in an immoveable Plain, deſcribes equal Areas in equal Times; and by Compoſition, the Area $SACS$ is to the Area $SAES$, as the Time which the Body takes to deſcribe *that*, is to the Time it takes to deſcribe *this.*



Let the Number of the Triangles be increaſed, and their Breadth diminiſhed *in infinitum*, then the Perimeter $ABCDE$ will be a Curve Line, and conſequently, the *Vis Centripeta*, which perpetually draws back the Body from off the Tangent of this Curve, acts continually; and the Areas $SACS$, $SAES$ proportional to the Times of their Deſcription, will alſo in this Caſe be proportional to the ſame Times. *Q. E. D.*

CONSECTARY I.

If a Body or Planet revolding in the Curve ABC, be attracted by a central Force in S, or gravitate towards the Sun there; and if the Body deſcribe the infinitely little Portions of the Curve AB and BC in equal Times, then the infinite little Triangles ASB, BSC will be equal; and if on the Centre S, and with the *Radii* SA, SB, the little Arches Ab, Bc, be deſcibed, then the Triangle SAB or $SAb = \frac{1}{2} SA \times Ab$, and the Triangle SBC is $= \frac{1}{2} SB \times Bc$; therefore it is, $\frac{1}{2} SA : \frac{1}{2} SB :: SA : SB :: Bc : Ab$; that is, the infinitely little Arches Ab, Bc, are proportional to the *Radii* SA, SB.



DEFINITION I.

The Centre of Attraction is that Point to which the revolving or moving Body is attracted or impelled by the Force or Impetus of Gravity; thus the Sun is ſuch in the Reſpect of the primary Planets, and the Earth in Reſpect of the Moon.

DEF. II.

Paracentric Motion of Impetus, is ſo much as the revolving Body approaches nearer to, or recedes farther from the Centre of Attraction; thus if S be the Centre of Attraction, and if a Body in A move to B, then $SB - SA = Bb$, is called the Paracentrick Motion of that Body.

DEF. III.

Circular Velocity of a Body is meaſured by the Arch of a Circle; thus if a Body in A move to B, or b, its circular Velocity is meaſured by the Arch of the Circle Ab deſcribe on the Centre of Attraction S, and the circular Velocity of a Body moving from B to C, is meaſured by the circular Arch BC.

DEF. IV.

Conatus Excuſſorius, is meaſured by a Line let fall from a Point infinitely near to another Point, perpendicular to a Line drawn to touch the Curve in that other Point; whence it is manifeſt that the *Conatus excuſſorius circulationis*, or *Conatus centrifugus*, may be expreſſed by BN the verſed Sine of the Angle of Circulation CSN (or by ck, becauſe the Difference between the *Radii* SC, SB, is incomparably little) for the verſed Sine is equal to a Tangent drawn to the other End of the Arch.

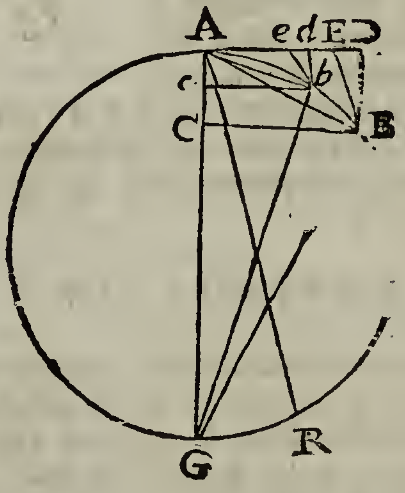
DEF. V.

Solicitatio paracentrica gravitatis vel levitatis, or the *Paracentrick Solicitation of* Gravity or Levity, is expreſs'd by the Right-line AL, drawn from the Point A, parallel to the Ray SB (infinitely near SA) until it interſect the Tangent BL.

LEMMA I.

The verſed Sines of infinitely little Arches *are in a duplicate Ratio of the* Chords *of the ſaid* Arches.

Let the Right-line AD touch the Circle ABG in A, then DAB is the Angle of Contact; Let AB be an infinitely little Arch, AB the Chord, and AC the verſed Sign thereof, I ſay, AC or BD is as the Square of AB; that is, if another infinitely little Arch Ab be taken, then the verſed Sine Ac (or bd) : Verſed Sine AC (or BD) :: $Abq : ABq$.



Draw the Diameter AG, and draw the Lines GB, Gb; then by the Property of the Circle, we have $ABq = AC \times AG$ and $Abq = AG \times Ac$; whence it is, $ABq : ABq :: AC \times AG : Ac \times AG :: AC : Ac :: BD : bd$.

Now when the Points B, b, are infinitely near the Point A, then the Chords AB, Ab, are equal to the Arches AB, Ab, and conſequently the verſed Sines AC, Ac, or the Subtenſes of the Angle of Contact BD, bd, are in a duplicate Ratio of the conterminal Arches AB, Ab.

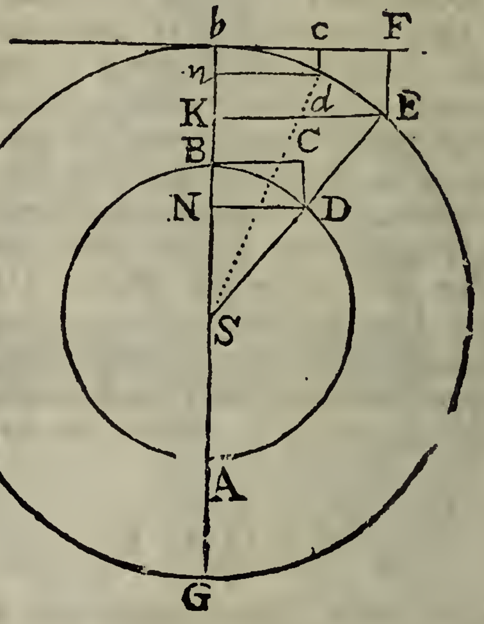
And if the Lines BE, be, ſubtend the Angle of Contact DAB, and be paralled to any Line (leſs than the Diameter AG) drawn within the Circle, as AR, then the Lines BE, be, will be as the Squares of the conterminal Arches AB, Ab, for $BD : bd :: BE : be :: ABq : Abq$.

COROL.

The Subtenſes of the Angles of Contact of Curves, whoſe Curvature in the Point of Contact is the ſame with that of ſome Circle (or when the Difference between them is incomparably little) are in a duplicate Ratio of the conterminal Arches.

LEMMA II.

In unequal Circles ABD, GbE, if the infinitely little Arches BD, bd be equal, then the verſed Sines BN, bn of theſe Arches will be reciprocally proportional to the Radii SB, Sb.



Produce SD unto E, and draw EF parallel to Sb, and draw the Lines DN, EK, dn perpendicular to SB.

Then it is, $bK : BN :: Sb : SB$.

And $bn : bK :: bdq : bEq$.

$$\text{But } bE = \frac{Sb}{SB} BD.$$

$$\text{Therefore, } bn : BN :: Sb \times BDq : \frac{Sbq}{SB} BDq.$$

$$\text{That is, } bn : BN :: \frac{bdq}{Sb} : \frac{BDq}{SB}.$$

And ſuppoſing $bd = BD$

We have $bn : BN :: SB : Sb$. Q. E. D.

PROP. II.

The Conatus Centrifugi, *or* Vires centripetæ *of Bodies revolving in equal Circles, with an equable Motion, are in a duplicate Ratio of their Velocities.*

The *Conatus centrifugus* is equal to the verſed Sine of the Angle of Circulation, and the verſed Sines of Arches infinitely little are in a duplicate Ratio of the Chords of thoſe Arches; that is, in a duplicate Ratio of the Arches themſelves, and the Velocities (the Times being ſuppoſed equal) are as the Arches; therefore the *Conatus centrifugi* are in a duplicate Ratio of the Velocities.

CONSECTARY I.

If two Bodies *B*, *b*, revolve in unequal Circles, *A B D*, *G b E*, and deſcribe the Areas *S B D*, *S b d*; then the *Conatus centrifugi* (or *Vires centripetæ*) *D C*, *d c*, will be in a Ratio compounded of the duplicate Ratio of the Velocities directly, and the ſimple Ratio of the Radii inverſely.

For if the Radii be equal, the *Conatus centrifugi* are as the Squares of the Velocities; and if the Velocities be equal, the *Conatus centrifugi* are reciprocally as the Radii; therefore if neither the Radii nor the Velocities be equal, the *Conatus centrifugi* are in a Ratio compounded of the Rationes of the Squares of the Velocities directly, and of the Radii inverſely.

This Corollary is demonſtrated more univerſally, in one of the Steps of the ſecond *Lemma*; for it is there $bn : BN :: \frac{bdq}{Sb} : \frac{BDq}{SB}$.

CONSECTARY II.

And if the Bodies *B*, *b*, deſcribe the equal Areas *B S D* and *b S d* in equal Times (that is, if $SB \times BD = Sb \times bd$, then $bd : BD :: SB : Sd$) then the Velocities *B D* and *b d* will be reciprocally as the Radii, and the Squares of the Velocities will be as the Squares of the Radii inverſely, whence the Proportion $bn : BN :: \frac{bdq}{Sb} : \frac{BDq}{SB}$ will become $bn : BN :: \frac{SBq}{Sb} : \frac{Sbq}{SB} :: \overline{SB}^3 : \overline{SB}|^3$, that is, the *Conatus centrifugi* are reciprocally in a triplicate Ratio of the Radii.

CONSECTARY III.

If the Velocities be directly as the Radii, then the periodic Times will be equal, and the Analogy $bn : BN :: \frac{bdq}{Sb} : \frac{BDq}{SB}$ will become $bn : BN :: Sb : SB$; that is, the *Conatus centrifugi* are proportional to the Radii.

CONSECTARY IV.

If the Bodies *B*, *b*, deſcribe the Arches *B D*, *b d* in equal Times, then the periodic Time of *b* will be to the periodick Time of *B*, as $\frac{Sb}{bd}$ is to $\frac{SB}{BD}$; becauſe the Times are directly as the Spaces and reciprocally as the Velocities; and becauſe $bn : BN (:: dc : DC) :: \frac{bdq}{Sb} : \frac{BDq}{SB} :: \frac{SB}{BDq} : \frac{Sb}{bdq} ::$ (Multiplying by $SB \times Sb$) $\frac{SB \times SBq}{BDq} : \frac{SB \times Sbq}{bdq}$. Therefore the *Vires centripetæ* are in a Ratio compounded of the Rationes of the Radii directly, and the Spaces of the periodic Times inverſely.

CONSECTARY V.

And if the Squares of the periodic Times be as the Radii, that is, if $\frac{Sbq}{bdb} : \frac{SBq}{BDq} :: Sb : SB$, then it will be $bn : BN :: \frac{Sb \times SBq}{BDq} : \frac{SB \times Sbq}{bdq}$ :: (by Subſtitution) $Sb \times SB : Sb \times SB$; that is, the *Vires centripetæ* are equal; and becauſe $\frac{Sb}{bdq} = \frac{SB}{BDq}$, therefore $\surd Sb : \surd SB :: bd : BD$; that is, the Velocities are in a ſubduplicate Ratio of the Radii. *Et vice verſa.*

CONSECTARY VI.

And if the Squares of the periodic Times be as the Squares of the Radii, that is, if $\frac{Sbq}{bdq} : \frac{SBq}{BDq} :: Sbq : SBq$, then it will be $bn : Bn :: \frac{Sb \times SBq}{BDq} : \frac{SB \times Sbq}{bdq}$ :: (by Subſtitution) $Sb \times SBq : SB \times Sbq :: SB : Sb$; that is, the *Vires centripetæ* (or *Conatus centrifugi*) are reciprocally as the Radii; and becauſe (in this Suppoſition) $SBq \times \frac{Sbq}{bdq} = Sbq \times \frac{SBq}{BDq}$, therefore $BD = bd$; that is, the Velocities are equal. *Et vice verſa.*

CONSECTARY VII.

If the Squares of the periodic Times be as the Cubes of the Radii, that is, if $\frac{Sbq}{bdq} : \frac{SBq}{BDq} :: Sb|^3 : \overline{SL}|^3$. Then it will be $bn : BN :: \frac{Sb \times SBq}{BDq} : \frac{SB \times Sbq}{bdq} :: SB \times \overline{SB}^3 : SB \times \overline{Sb}^3 :: SBq : Sbq$; that is, the *Vires centripetæ* are reciprocally in a duplicate Ratio of the Radii; and becauſe $\frac{SB}{bdq} = \frac{Sb}{BDq}$, therefore $\surd\overline{SB} : \surd\overline{SB} :: bd, BD$; that is, the Velocities are reciprocally in a ſubduplicate Ratio of the Radii. *Et vice verſa.*

SCHOLIUM.

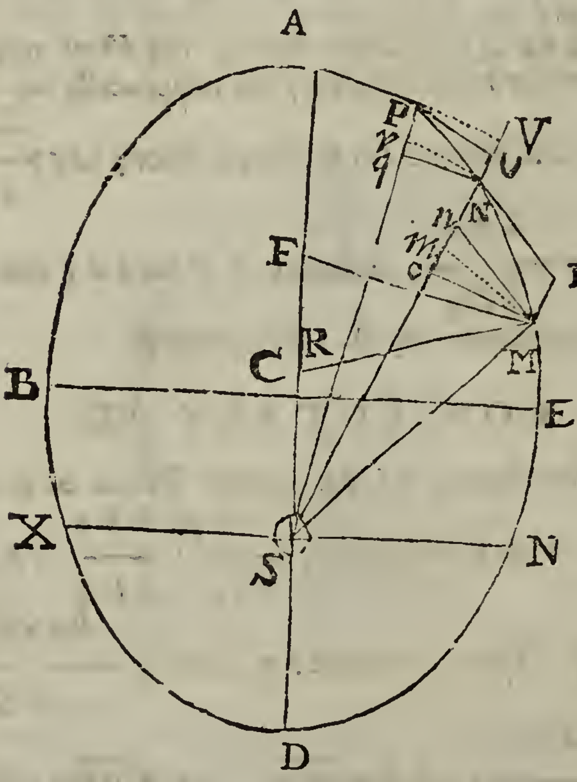
And becauſe it is found by Obſervation, that the Squares of the periodic Times of Planets, are as the Cubes of their Diſtance from the Sun; and that in equal Times they deſcribe equal Areas about the Sun: Therefore it is manifeſt, that the Sun is the Centre of all the Planetary Motions; and that the *Vis centripeta* (or Force of Gravity) of one Planet, is to the *Vis centripeta* of another Planet, as the Square of this Planet's Diſtance from the Sun, is to the Square of that Planet's Diſtance from the Sun.

It is alſo evident, that thoſe Planets which are neareſt the Sun move ſwifteſt, for the Velocity of one Planet is to the Velocity of another Planet, as the Diſtance of this Planet from the Sun is to a mean Proportional between the Diſtances of this and that Planet from the Sun.

PROP. III.

If the Area which a Body, revolving about an immoveable Centre, deſcribes by Rays drawn to the ſaid Centre, be proportional to the Times of Deſcription, the Elementum or infinitely little Increment or Decrement of the paracentric Impetus is equal to the Difference or Sum of the paracentric Solicitation (Solicitation *of Gravity, or the Impreſſion made by the Action of Gravity or Levity, or any ſuch like Cauſe) and twice the* Conatus centrifugus, *viz. to the Sum, if it be the* Solicitation *of Levity ; or to the Difference, if the paracentric* Solicitation *ariſe from the Action of Gravity.*

From the Points P and M, draw the Lines $P\,v$, $M\,o$ perpendicular to $S\,N$; then becauſe the Triangles $P\,S\,N$, $N\,S\,M$ are equal, (the Times being ſuppoſed equal) therefore (becauſe the Baſe $S\,N$ is common to both) the Altitudes $P\,v$, $M\,o$ are equal; take $N\,n = L\,M$, and draw $M\,n$ parallel to $L\,N$; then the Triangles $P\,N\,v$, $M\,n\,o$ will be equal and ſimilar, and $P\,N = M\,n$, and $N\,v = o\,n$; again in the Right-line $S\,N$ (produced if Need be) take $S\,V = S\,P$, and $S\,m = S\,M$, then is $N\,V$ the Difference between the *Radii* $S\,P$, and $S\,N$, and $M\,m$ is the Difference between the *Radii* $S\,N$ and $S\,M$; now $N\,V$ is $= (N\,v)\,n\,o + V\,v$; and $N\,m$ is $= N\,n + n\,o = o\,m$, therefore $N\,V - N\,m = V\,v + m\,o - N\,n =$ to the differentio-differential, or infinitely little Increment or Decrement of the paracentric Velocity, $= 2\,m\,o - N\,n$ (becauſe $V\,v$ and $m\,o$, the verſed Sines of two Angles and *Radii*, whoſe Difference is incomparably little, are equal.) Now the Difference between the *Radii* $S\,P$, $S\,N$, and $S\,N$, $S\,M$, expreſſes the paracentric Velocity, and their Difference again is the infinitely little Increment or Decrement of the ſaid paracentric Velocity; and $m\,o$ or $V\,v$ is equal to the *Conatus centrifugus circulationis*, and $N\,n$ is $=$ to the Solicitation of Gravity; therefore the *Elementum* of the paracentric Velocity is equal to the Difference between twice the *Conatus centrifugus* $(2\,m\,o)$ and the ſimple Solicitation of Gravity $(N\,n.)$ or (which may be proved in like Manner) to the Sum of twice the *Conatus centrifugus*, and the ſimple Solicitation of Levity,



CONSECTARY I.

Hence it appears, that if the Solicitation of Gravity prevail, then $N\,V - N\,m$ will be Negative, that is, $N\,m$ will be greater than $N\,V$, and the deſcenſive paracentric Velocity increaſes, and the aſcenſive decreaſes. But if twice the *Conatus centrifugus* prevail, then $N\,V - N\,m$ will be poſitive, and the aſcenſive paracentric Velocity increaſes, and the deſcenſive decreaſes.

CONSECTARY II.

If the *Elementum*, or infinitely little Increment or Decrement of the paracentric Velocity be given, the Solicitation of Gravity or Levity may be found; for the *Conatus centrifugus* is always given (by *Conſ.* 2. *Prop.* 2.) it being conſtantly in a triplicate reciprocal Ratio of the *Radii.*

PROP. IV.

The Angles which a Planet deſcribes about the Sun, in equal Times, are reciprocally in a duplicate Ratio *of the* Radii.

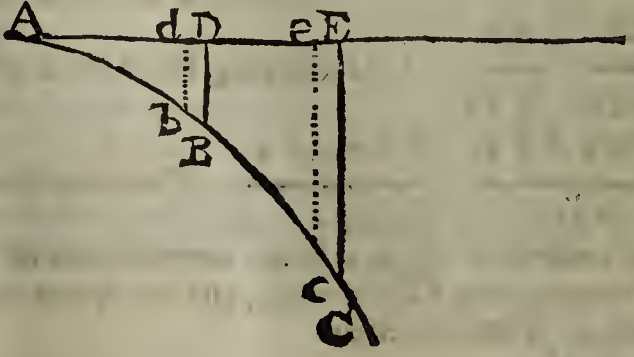
The circular Velocities are in a Ratio compounded of the Rationes of the Angles and Radii, jointly; therefore the Angles are in a Ratio compounded of the direct Ratio of the circular Velocities, and the reciprocal Ratio of the Radii: But becauſe in equal Times the Areas are equal, (*Conſ.* 2. *Prop.* 2.) therefore the circular Velocities are reciprocally as the Radii, and conſequently the Angles are reciprocally in a duplicate Ratio of the Radii.

And ſuch are the apparent diurnal Motions of the Planets obſerved from the Sun (for Days, in ſuch Caſes, are Parts of Time little enough, eſpecially in Planets more remote from the Sun) which are almoſt reciprocally as the Squares of their Diſtances from the Sun; ſo that a Planet, in a given Element of Time, deſcribes but the fourth Part of that Angle, which it would deſcribe at half its preſent Diſtance from the Sun.

LEMMA III.

The Spaces which a Body deſcribes in the beginning of its Deſcent, are in a duplicate Ratio of the Times.

Let the Right-line A E be divided into an infinite Number of equal Parts *d* D, *e* E, *&c.* repreſenting

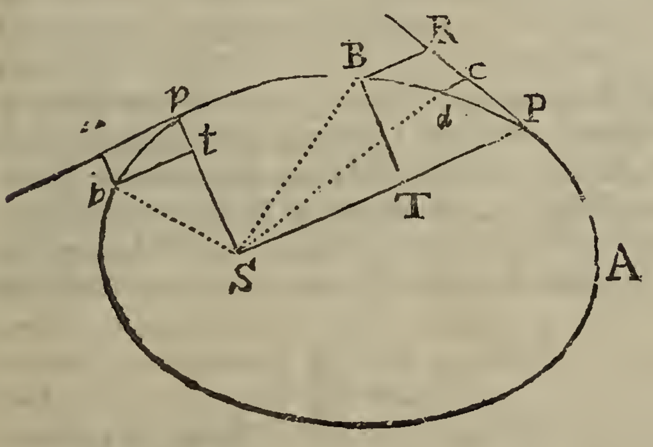


repreſenting equal Moments of Time; and draw the Ordinates B D, E C, &c. proportional to the Velocities of the heavy Body, at the End of the Times repreſented by A D, and A E, and deſcribe the Curve A B C. Now becauſe the Space which a Body deſcribes, is proportional to the Time of Deſcription, and the Velocity jointly; it is evident, that the Space which the heavy Body deſcribes in the Moment of Time D *d*, is proportional to the Rectangle D *b*; and the Space which the ſame heavy Body deſcribes in the Moment of Time E *e*, is proportional to the Rectangle E *e*: Whence the Space which the Body deſcribes in the Time A D, is to the Space it deſcribes in the Time A E, as the curvilineal Space A D B, is to the curvilineal Space A E C, but when the Body begins to deſcend, the Ordinates D B, E C, are indefinitely near the Point A; in which caſe the trilineal Figures A D B, A E C, become rectilineal ſimilar Triangles, the indefinitely little Portions A B, B C, being in the ſame ſtrait Line. Now the Areas of ſimilar Triangles are in a duplicate Ratio of the homologous Sides; that is, the Area A B D, Area : A E C :: A D *q* : A E *q*; therefore the Spaces which a heavy Body deſcribes in the Beginning of its Deſcent, are in a duplicate Ratio of the Times. *Q. E. D.*

P R O P. V. *Problem* I.

If a heavy Body revolving in the Periphery of a Curve, about an immoveable Centre, deſcribe Areas proportional to the Times; 'tis required to find the Law of the Vis centripeta *tending to the ſaid Centre.*

Suppoſe a Body P to be projected in the Line P R from P towards R, and let the Body at the ſame time be attracted by a Force in S, ſo



that by a Motion compounded of the projectile and attractive Forces, it deſcribe the Curve A P *p*; and let the Line P R touch the ſaid Curve in P; draw S P, and aſſume any Point B in the Curve indefinitely near P; and draw B R parallel to S P, and B T perpendicular to S P; aſſume another Point *p* in the Curve; and draw S *p*, the Tangent *p r* and *r b* parallel, and *b t* perpendicular to S *b*, and ſuppoſe the Body deſcribes the Arches P *d*, *p b* in equal Times; and draw *d c* parallel to S P: Then the Ratio of the *Lineola naſcens* B R to the *Lineola naſcens b r*, is compounded of the Rationes of B R to *d c*, and of *d c* to *b r*: But (*Lem.* 1. and *Cor.*) B R is to *d c*, as the Square of the Arch P B, is to the Square of the Arch P *d*; and becauſe the Arches P B, P *d* are indefinitely little, they are proportional to the Triangles P S B, P S *d*; (*Lemma* 3.) that is, they are proportional to the Times the Body takes to deſcribe them, or to the Times which the Body takes to deſcribe the Arches P B, *p b*, and conſequently B R is to *d c*, as the Square of the Time which the Body takes to deſcribe the Arch P B, is to the Square of the Time it takes to deſcribe the Arch *p b*; again, becauſe P *d* and *p b* are ſuppoſed to be deſcribed in equal Times, therefore *d c* is to *b r*, as the *Vis centripeta* in P is to the *Vis centripeta* in *p*; whence it is evident that B R is to *b r* in a Ratio compounded of the Rationes of the Squares of the Times in which the Arches P B, *p b* are deſcrib'd, and of the *Vis centripeta* in P to the *Vis centripeta* in *p*; that is, (becauſe the Times of deſcribing the Arches P B, *p b*, are proportional to the Triangles P S B, *p* S *b*, or to the Rectangles S P × B T, S *p* × *b t*.)

$$BR : br :: V \times SPq \times BTq : v \times Spq \times btq.$$

And by Diviſion $\frac{BR}{SPq \times BTq} : \frac{br}{Spq \times btq} :: V : v.$

Or $\frac{Spq \times btq}{BR} : \frac{SPq \times BTq}{BR} :: V : v.$

That is, the *Vis centripeta* in P, is as the Solid $\frac{SPq \times BTq}{BR}$ inverſely.

This may be more briefly demonſtrated thus: If the Times be equal, B R is as the *Vis centripeta*; And if the *Vis centripeta* be given, then B R (*Prop.* 1 *Lem.* 3.) is as the Square of the Times; and if neither the Times nor the *Vis centripeta* be equal, then B R is ſuppoſing $V =$ to the *Vis centripeta* in P, and $T =$ to the Time of Deſcription) as VT, therefore V is as $\frac{BR}{T}$; and becauſe the Time is as the Area P S B, or as the Rectangle S P × B T, therefore V is as $\frac{BR}{SPq \times BTq}$ directly, or as $\frac{SPq \times BTq}{BR}$ inverſely. *Q. E. D.*

C O R O L L A R Y

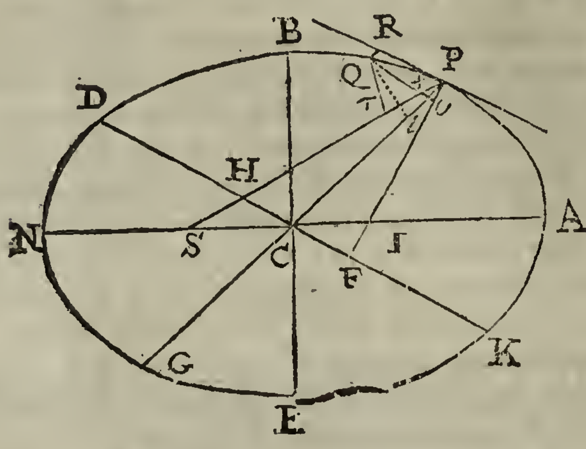
Hence if any Figure, as A P *p*, be given, and the Point S, to which the *Vis centripeta* tends; then the Value of the Solid $\frac{SPq \times BTq}{BR}$ may be determined from the Nature of the Figure; and conſequently the Law of the *Vis centripeta*, which is reciprocally as the ſaid Solid, may be found.

P R O P. VI. *Problem* II.

If a Body revolve in the Periphery of an Ellipſis; 'tis required to find the Law of the Vis centripeta, *tending to the Focus of the Ellipſis.*

Let A B D be the *Ellipſis*, and S the *Focus* to which the *Vis centripeta* tends. Draw the Axis A N; and A N, the conjugate Diameter B E; draw the Line P R touching the Curve in any Point (P) and draw the Diameter P G, the conjugate Diameter D K, P F perpendicular to D K, and Q *v* parallel to P R: Draw S P interſecting D K in H, and interſecting Q *v* in *x*; and draw Q R parallel to S P. Then (*Hay's*, *Art.* 51.) P H = A C;

draw Q T perpendicular to S P ; and ſuppoſ the



Parameter of the Axis$\left(\frac{2\,B\,C\,q}{A\,C}\right) = L$. Then,

$L \times Q\,R : L \times P\,v :: Q\,R : P\,v :: P\,x : P\,v ::$
$P\,H : P\,C :: A\,C : P\,C$.

$L \times P\,v :: G\,v \times P\,v :: L : G\,v$.

$G\,v \times P\,v : Q\,v\,q :: C\,P\,q : C\,D\,q$.

And becauſe $Q\,v\,q$ is $= Q\,x\,q$, when Q is infinitely near P. Therefore,

$Q\,x\,q\,(= Q\,v\,q) : Q\,T\,q ::$ (by ſimilar Triangles) $H\,P\,q\,(= A\,C\,q) : P\,F\,q ::$ (*Hay's Art.* 60.) $C\,D\,q : C\,B\,q$.

And multiplying the reſpective Terms of theſe Analogies into one another, there will ariſe this ;

$L \times Q\,R : Q\,T\,q :: L \times AC \times CPq : Gv \times CBq \times CP$.
Viz. $L \times Q\,R : Q\,T\,q :: 2\,B\,C\,q \times C\,P\,q : Gv \times B\,Q\,C \times C\,P$.
$L \times Q\,R : Q\,T\,q :: 2\,P\,C : G\,v$.

But when the Point Q is indefinitely near P, then $2\,P\,C = G\,v$.

Whence $L \times Q\,R = Q\,T\,q$.

And multiplying both Sides of the Equation by $\frac{S\,P\,q}{Q\,R}$, we ſhall have $L \times S\,P\,q = \frac{S\,P\,q \times Q\,T\,q}{Q\,R}$. (*Cor. Prop.* V.) Therefore the *Vis centripeta* is reciprocally as $L \times S\,P\,q$; and becauſe L is a determinate Quantity, therefore the *Vis centripeta* is reciprocally as the Square of (S P) the Diſtance of the Body in P from the Centre of Attraction S. *Q. E I.*

COROLLARY I.

The Parament of the Axis (L) is equal to $\frac{Q\,T\,q}{Q\,R}$.

COROLLARY II.

If the Centre of Attraction S, and the adjacent Vertex N, be ſuppoſed immoveable, and if the other Foci I approach nearer and nearer to S, and at laſt coincide with the ſame, then the Body will revolve in the Periphery of a Circle, and the Law of the *Vis centripeta* will be the ſame as in the Ellipſis.

COROLLARY III.

If the Vertexes A and N be given, and if the Focus I coincide with A, and the Focus S coincide with N, then the Ellipſis $A\,P\,N$ will become a ſtreight Line coinciding with the Diameter $A\,N$, and the Body will move in the ſame, without any Attraction from without the Line.

COROLLARY IV.

If the Vertex N, and the (Focus of the Ellipſis, or) Centre of Attractſon S be given ; and if the other Focus I be at an infinite Diſtance from S, then the Ellipſis $N\,P\,A$ will degenerate into a Parabola, and the *Vis centripeta* in P will be as the Square of the Diſtance $N\,P$ inverſively.

COROLLARY V.

The ſame Things being ſuppoſed, if the Focus I be at more than an infinite Diſtance from S ; that is, if it fall on the contrary Side of N in reſpect of S, then the Body will move in the Curve of an Hyperbola, and the *Vis centripeta* will be reciprocally as the Square of the Diſtance from the Focus S.

COROLLARY VI.

If the Focus I and the Vertex A be given ; and if the Centre of Attraction S be ſuppoſed at an infinite Diſtance from I, then the Curve $A\,P$ will be a Parabola, and the *Vis centripeta* will be the ſame in every Point of the Curve ; and contrarily, if a Body moving at firſt in a ſtreight Line, be attracted to a Centre at an infinite Diſtance from the ſame, then that Body will move in the Curve of a Parabola, and the Centre of Attraction will be in the Axis of the Parabola, at an infinite Diſtance from the Vertex.

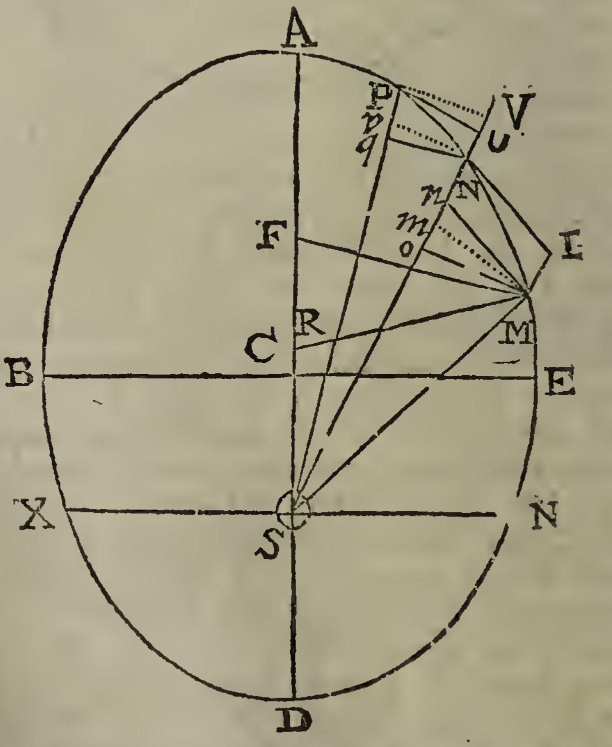
SCHOLIUM.

It may be ebſerv'd that the Paracentric Solicitation *of* Gravity, *and the* Vis centripeta, *are Terms ſignifying the ſame thing.*

PROP. VII.

The Solicitation *of* Gravity, *or* Vis centripeta *of a Planet, is to the* Conatus centrifugus *of the ſame Planet, as its preſent Diſtance from the* Sun *is to one half the Parameter of the planetary Ellipſis.*

Suppoſe $S\,M = D$, and $L =$ to the Parameter of the Axis ; and let $t \times L$ be a conſtant Plane



Plane equal to twice the Elementary Triangle *M S N*: Then the Arch *M m* is $= \frac{t \times L}{D}$, and *M m q* is $= \frac{t^2 \times L^2}{D^2}$, and *m o* $= \frac{M m q}{2 S M} = \frac{t^2 \times L^2}{D_3}$ = to the *Conatus centrifugus.*

Again, the Solicitation of Gravity is as $\mathcal{D}^2$, inverſely, or as $\overline{M m}\big|^2$, or $\frac{t^2 \times L^2}{\mathcal{D}^2}$ directly, or as (dividing by the invariable Quantity $\frac{1}{2} L$) $\frac{2 \times t^2 \times L}{\mathcal{D}^2}$ directly. Whence it is evident that the Solicitation of Gravity is in the *Conatus centrifugus*, as $\frac{2 \times t^2 \times L}{\mathcal{D}^2}$ is to $\frac{t \times L^2}{2 \mathcal{D}_3}$, or as $\mathcal{D}$ is to $\frac{1}{4} \mathcal{D}$, and becauſe $\frac{1}{4} L$ is an invariable Quantity, the Rationes of the Solicitation of Gravity to the *Conatus centrifugus* are proportionable to the Diſtances of the Planet from the Sun.

PROP. VIII.

The greateſt Aſcenſive or Decenſive paracentrick Velocity of a Planet, is when the Diſtance of the Planet from the Sun is equal to Half of the Parameter of the Axis of the Ellipſis.

Draw *S W* perpendicular to the Axis *A D*, I ſay the greateſt paracentrick Velocity is in *W* or *X*. For the Solicitation of Gravity is to the *Conatus centrifugus*, as *D* is to $\frac{1}{4} L$; and the Solicitation of Gravity is to twice the *Conatus centrifugus*, as *D* is to $\frac{1}{2} L$; and becauſe *S W* = *D* is = $\frac{1}{2} L$, therefore in the Point *W* (or *X*) the Solicitation of Gravity is equal to twice the *Conatus centrifugus*; and (by *Prop.* 3.) conſequently the Fluxion of the paracentrick Velocity is = 0: Whence it is evident, that if on *S* as a Centre, a Circle be deſcribed with a Radius equal $\frac{1}{2}$ the Parameter of the Axis, it will cut the Orbit of the Planet in two Points *W* and *X*, in which the greateſt paracentrick Velocity happens.

COROLLARY.

The *Conatus centrifugus* of receding from the Sun, is always leſs than the Solicitation of Gravity; for the Solicitation of Gravity is always to the *Conatus centrifugus*, as the Diſtance of the Planet from the Focus is to 1 4th Part of the Parameter of the Axis; and in the Ellipſis, the Diſtance of a Planet from the Focus, is always greater than 1 4th Part of the Parameter of the Axis. Therefore, *&c.*

PROP. IX.

The Impetus *which a Planet acquires (during the whole Time of its Motion) by the continued Attraction of the* Sun, *are proportional to the Angles of Circulation; that is, as the Angles of apparent Motion from the* Sun.

I ſay, That *Impetus* which a Planet acquires, as it moves from *A* to *P*, is to the *Impetus* which it acquires, moving from *A* to *M*, as the Angle *A S P* is to the Angle *A S M*: For the Increments of thoſe Angles (*Prop.* 4.) are reciprocally as the Squares of the Radii or Diſtances; that is (*Cor. Prop.* 5.) as the Solicitations or Impreſſions of Gravity: Therefore the Sum of theſe is proportional to the Sum of thoſe; that is, the Sum of all the *Impetus* or Impreſſions of Gravity acquir'd from *A* to *P*, is to the Sum of all the Impreſſions of Gravity acquired from *A* to *M*, as the Angle at *A S P* is to the Angle *A S M.*

COROLLARY.

Hence in the Point *W* (in which an Ordinate to the Axis drawn through the Focus *S*, interſects the Ellipſis) the *Impetus* which a Planet hath acquired ſince it deſcended from the Aphelion, is equal to half the *Impetus* acquired from the Aphelion to the Perihelion; and in the ſaid Point *W*, the Diſtance of the Planet from the Sun is = $\frac{1}{2}$ the Parameter of the Axis of the Figure.

And the *Impetus* which a Planet, deſcribing any Arch of its Orbit, acquires, is to the *Impetus* acquired in a Semi-revolution, as the Angle of apparent Motion is to two Right Angles; the *Impetus* here meant is that impreſs'd by Gravity or Attraction, ſimply conſidered by themſelves, the contrary *Impetus* ariſing from the *Conatus centrifugus* not being conſidered.

PROP. X.

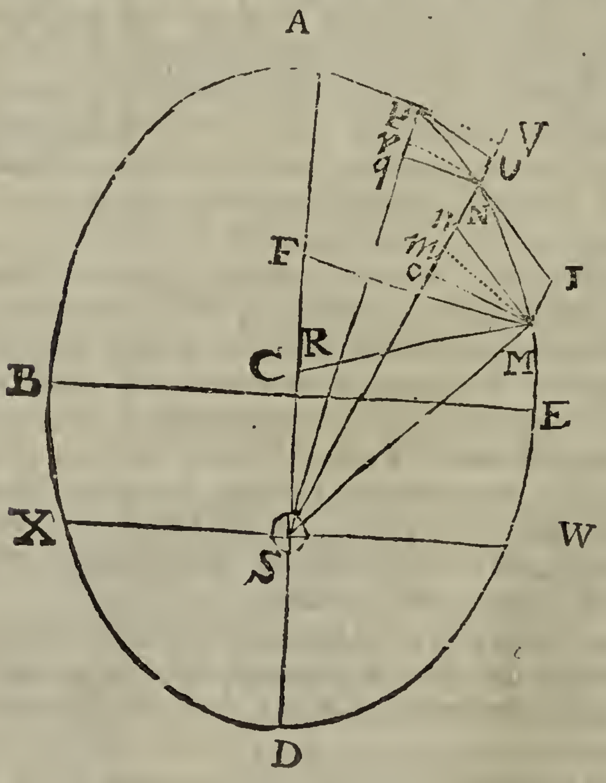
To explain the Motion of a Planet through the whole Revolution; and to ſhew how a Planet approaches to, and again recedes from the Sun alternis Vicibus.

If a Planet be at its greateſt Digreſſion from the Sun, or in the Aphelion *A*, the *Conatus centrifugus* and the Solicitation of Gravity, are leſs than if it were nearer to the Sun. But at that Diſtance, *viz.* in the Aphelion A, the Solicitation of Gravity is greater than twice the *Conatus centrifugus*, (becauſe *S A*, the Diſtance of the Aphelion from the Sun, is greater than half the Parameter *S W*) therefore the Planet will deſcend towards the Sun in the Curve Line *A P M D*, and (*Prop.* 3.) the deſcenſive *Impetus* will continually increaſe, as in heavy accelerated Bodies, ſo long as the Solicitation of Gravity is ſtronger than twice the *Conatus centrifugus:* For, the deſcenſive paracentrick Motion increaſes, as long as the Solicitation of Gravity is greater than twice the *Conatus centrifugus*; and therefore the deſcenſive paracentrick Motion will increaſe (although the infinitely little Increment of the paracentrick Motion decreaſe at the ſame time) until the Planet arrive at *W*, in which Point the Solicitation of Gravity is equal to twice the *Conatus centrifugus*; and conſequently the paracentrick Velocity is greateſt at *W*, when the Diſtance of the Planet from the Sun is equal to half the Parameter of the Orbit: Afterwards, although the Planet continues to approach nearer and nearer to the Sun, until it come to *D*, yet the paracentrick Velocity decreaſes; for the Solicitation of Gravity is to twice the *Conatus centrifugus*, as the Diſtance of the Planet from the Sun, is to half the Parameter of the Orbit; and conſequently, all the while the Planet is in deſcribing the Portion of the Orbit *W D X*, twice the *Conatus centrifugus* is greater than the Solicitation of Gravity; and from *W* to *D* the paracentrick Velocity decreaſes, which it continues to do, until the centrifugal Impreſſions collected into one, from the Aphelion *A*, preciſely deſtroy all the Impreſſions of Gravity collected into one, from the Aphelion *A*, or until the centrifugal *Impetus* be equal to the centripetite *Impetus.* Now this happens in the Perihelion *D*, where the paracentrick Velocity vaniſhes, and in which the *Conatus centrifugus* and Solicitation of Gravity are equal and contrary, ſo that the Planet cannot approach nearer the Sun than it is in this Point *D*.

Afterwards, the Motion being continued : As the Planet hath hitherto approached to, ſo now it begins to recede from the Sun in the Focus *S*, and endeavours to move from *D* by *X* towards *A*. For twice the *Conatus centrifugus*, which began to exceed the Solicitation of Gravity in *W*, continues to prevail from *D* to *X*; and therefore, ſeeing the Planet begins to move (as it were a-new) from *D* to *X*, the former contrary *Impetus* (mutually deſtroying each other) the centrifugal paracentrick Velocity increaſes from *D* to *X*, but the Increment thereof, or the Impreſſion decreaſes, until the Planet arrive in *X*, where the Solicitation of Gravity is equal to twice the *Conatus centrifugus* ; therefore the greateſt centrifugal paracentrick Velocity is in *X*; from *X* to *A*, the Solicitation of Gravity prevails above twice the *Conatus centrifugus* and conſequently, the centrifugal paracentrick Velocity decreaſes, until the Planet arrive in the Aphelion *A*, in which Point the *Conatus centrifugus* and Solicitation of Gravity become equal and contrary, and conſequently mutually deſtroy each other : And thus the Planet returns to *A*, from whence it departed, and begins and finiſhes new Revolutions ſucceſſively, and without Interruption.

CONSECTARY I.

Hence we have ſix remarkable Points in the Elliptick Orbit of a Planet, *viz.* four obvious, *A* the Aphelion, *D* the Perihelion, *E* and *B* the mean Diſtances (for *S B* or *S E* is $=\frac{1}{2}$ the tranſverſe Axis *A D*, and conſequently an Arithmetical Mean between *S A* and *S D*, the greateſt and leaſt Digreſſion of a Planet from the Sun*)* and two more, *viz.* *W* and *X*, being the Extremities of the Parameter of the Orbit applied to the Axis in the Focus *S*, which Points happen in the greateſt aſcenſive or deſcenſive paracentrick Velocity.



CONSECTARY II.

The *Impetus* which a Planet acquires by the Action of Gravity from *A* to *W* is equal to half the *Impetus* which it acquires in its Deſcent from *A* to *D*, and the *Impetus* acquir'd from *A* to *W* is = to that acquir'd from *W* to *D* ; for the *Impetus* are proportional to the Angles of apparent Motion, and the Angles *A S W* and *W S D* are Right Angles.

CONSECTARY III.

Hence to determine the Species of the planetary Ellipſis ; the Focus of the Ellipſis *S* is given ; and the Point *A* where the Planet is when the Sun begins to attract it, being ſuppoſed at the greateſt Diſtance of the Planet from the Sun, the remoter Vertex of the Ellipſis is alſo given, and the Proportion between the Solicitation of Gravity, or Force or Gravity, wherewith the Sun begins to attract the Planet in *A*, and the *Conatus centrifugus* in the ſame Point *A* being known ; the principal Parameter of the Orbit *W X*, or an Ordinate applied to the Axis in the Focus *S*, may be found. For *S A* (given) is to *S W* ($=\frac{1}{2}$ the Parameter of the Orbit) as the Force of Attraction in *A* is to twice the *Conatus centrifugus*, and if $\frac{1}{4}$ the Parameter be ſubtracted from *S A*, the greateſt Diſtance of the Planet from the Sun, the Remainder will be to *S A*, as *S A* is to *S D* ; therefore *A D* the tranſverſe Axis of the Ellipſis is alſo given ; whence the planetary Ellipſis may be deſcribed.

CONSECTARY IV.

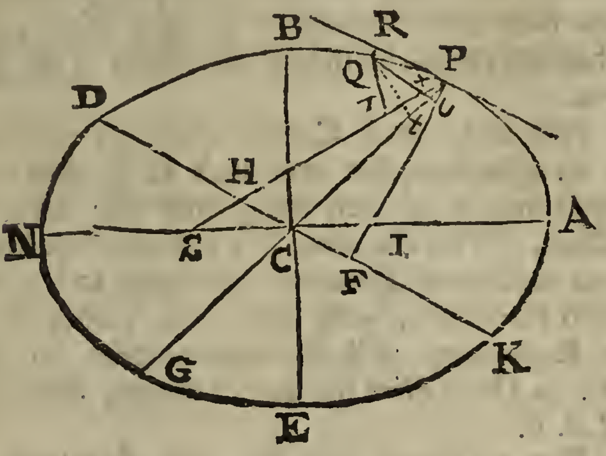
A Planet will deſcribe a Circle, when the Solicitation of Gravity, and twice the *Conatus Centrifugus* are equal at the Beginning of the Attraction, for in that Caſe they will remain equal, there being no Cauſe to make the Planet approach nearer to, or recede farther from the Centre of Attracton about which it revolves ; but when in the Beginning the Force of Attraction and twice the *Conatus centrifugus* are unequal (provided the ſimple *Conatus centrifugus* be always leſs than the Attraction) then the ſaid Planet will deſcribe an Ellipſis ; and if the Force of Attraction prevail, the Point where the Motion begins is the Aphelion ; or if twice the the *Conatus centrifugus* prevail, then the ſaid Point is the Perihelion.

PROP. XI.

If ſeveral Bodies revolve round a common Centre, and if the Vires centripetæ *be reciprocally as the Squares of their Diſtances from that Centre, then in Ellipſes, the Squares of the periodick Times will be as the Cubes of the tranſverſe Axes of the Ellipſes.*

Reaſſume the Symbols in *Prop.* 6. then the Parameter of the Axis of the Figure *L* (*Prop.* 6. *Cor.* 1.) is $=\frac{Q\,T\,q}{Q\,R}$, when the Point *Q* is infinitely near *P*, and if the Times be equal, then *Q R* is directly as the *Vis centripeta*, or reciprocally as (the Square of the Diſtance) *S P q* ; therefore *L* is as $Q\,T\,q \times S\,P\,q$; that is, the *Latus Rectum* (*L*) is as the

Square of the Area $QT \times SP$; and the Area $QT \times SP$, or $\frac{1}{2}$ $QT \times SP$ is in the ſubduplicate Ratio of the Parameter (*L.*)



And if the periodick Times be equal, the Areas of the Ellipſes are in a ſubduplicate Ratio of the Parameters; and if the Parameters be equal, the Areas are proportional to the periodick Times; and if neither the Parameters nor the periodick Times be equal, then the Areas of the Ellipſes are in a Ratio compounded of a ſubduplicate Ratio of the Parameters, and the ſimple Ratio of the periodick Times; therefore the periodick Times are in a Ratio compounded of the direct Ratio of the Areas, and the reciprocal ſubduplicate Ratio of the Parameters. Now the Areas of unequal Ellipſes, are (*Art.* 105. *Hay*'s N° 4.) in a ſubduplicate Ratio of the Parameters, and the ſubduplicate Ratio of the Cubes of the tranſverſe Axis jointly. Therefore the periodick Times are in a Ratio compounded of the ſubduplicate Ratio of the Parameters directly, the ſubduplicate Ratio of the Cubes of the tranſverſe Axes directly, and the ſubduplicate Ratio of the Parameters inverſely; that is, the periodick Times are in a ſubduplicate Ratio of the Cubes of the tranſverſe Axes, and conſequently the Squares of the periodick Times are proportional to the Cubes of the tranſverſe Axes. *Q. E. D.*

C O R O L.

The Squares of the periodick Times of Bodies revolving in Ellipſes, are as the Cubes of their Diſtances from the (Focus of the Figure or) Centre of Attraction.

Books on this Subject of Aſtronomy *of more immediate and neceſſary Uſe, are ſuch as theſe.*

Gregory's Aſtronomy, *Lat.* in *Fol.*

Flamſtead's Doctrine of the Sphere at the End of Sir *Jonas Moor*'s 1. Vol. of Mathem.

N. Mercator's Aſtronomy, *Lat. Lond.* 1676. 8*vo.*

Gaſſendus's Aſtronomy.

Biſhop *Ward*'s Aſtronomy.

Tacquet's Aſtronomy, in his *Opera Math.*

Halley's Catalogue of the Southern Stars. *Oxon.* in 4*to.*

An Eſſay concerning the Cauſes of the Celeſtial Motions, in the *Leipſick* Acts of *Feb.* 1689. By *G. G. Leibnitz.*

Kepleri Epitome Aſtronomiæ Copernicanæ.

Wing's *Harmonicon Celeſte.*

Street's *Aſtronomia Carolina.*

Jer. Horrocci Op. poſthuma.

Bayeri Uranometria.

Bullialdi Aſtronom. Philolaica.

Hugenii Syſtem. Saturnianum.

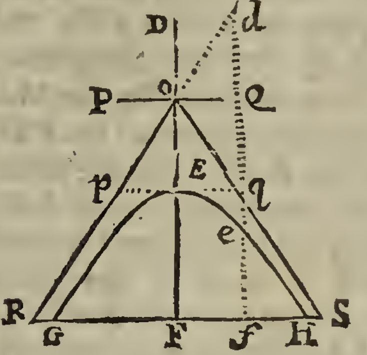
Whiſton's *Prælectiones Aſtronomicæ.*

ASYMMETRY, (of *α priv.* and Συμμετεία, *Gr.*) the ſame with *Incommenſurability*; which ſee.

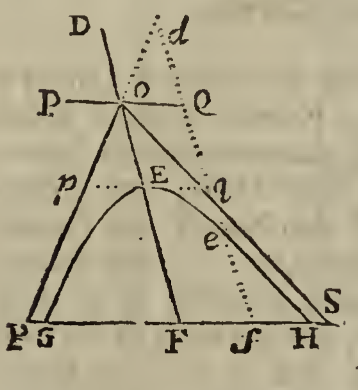
ASYMMETRAL, the ſame with *incommenſurable.*

ASYMPTOTES, (Ασύμπτοτες, *Gr.*) are Lines which continually approach nearer to each other, but though continued infinitely, can never meet. Of theſe there are many Kinds, as the Curve of the *Conchoid*, &c. but it may be enough here to mention the Famous

ASYMPTOTES *in Conick Sections*, which are the Lines *O S* and *O R*; and are thus drawn: Imagine, in the *Hyperbola*, the ſecond or conjugate *Axis P Q* to deſcend ſtill keeping parallel to the *Ordinates*, till it touch the *Vertex* of the Section *E*, for then, if thro' the Centre *O*, you draw Lines thro' the Ends of this Tangent Line *p. q.* Theſe are the Famous *Aſymptomes* mention'd by *Apollonius*, *Lib.* 2. *Prop.* 1. and of which he demonſtrates, that though infinitely produced, and though the Curve come continually nearer and nearer to them, yet can they never be co-incident with the Sides of the *Hyperbola*, nor ever meet it, or touch it; whence comes their Name of *Aſymptotes*: And by ſome *Latin* Writers they are called *Intactæ*, for the ſame Reaſon. This *Non-Coincidence* appears very plainly, where the Section of the *Hyperbola* is made parallel to the Triangular Section of a Cone by the Ax; as,

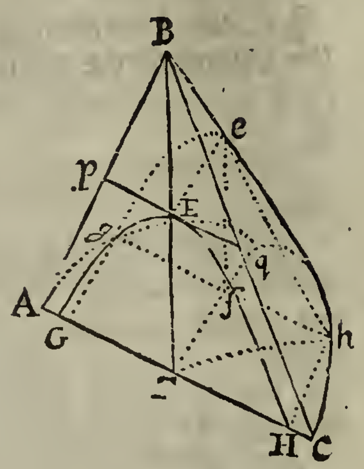


Suppoſe along the Line *e f* parallel to *E F.* For if you imagine the *Hyperbola g e b* to be moved forward parallel to itſelf, as far as the Length of the equal and parallel Lines, *g G*, *f F*, *E q*, *H b*, till it come to be in the Poſition *G E H*, or to be coincident with the Triangular Section by the Axis, then it will be manifeſt, that the Hyperbolick Line *G E H* is diſtant each Way from the *Aſymptotes B C*, *B A*, by the Length of the verſed Sines of the equal Arks *b C* and *g A* in the Circumference of the circular Baſe of the Cone; and that at the ſame time it comes, if produced, ſtill nearer and nearer to them. And conſequently, I ſay,



1. *R G* and *H S*, or *A G* and *H C* being always equal to one another; as are alſo the Ordinates *G F* and *F H*, &c. The Rectangles *R G S* and *S H R*, *A G C* and *C H G*, will always be reſpectively equal to one another.

2. The *Curve* and the *Aſymptote* can never meet, becauſe the Circles generated by *E Q*, and the Rings generated by *R S*, and *H C*, &c. (which will



ariſe from the imaginary Revolution of the whole Figure round the Axis *F E*) will always be equal to one another, and to the Circle made by the Revolution of the Radius *E q*, as is plain by comparing this laſt Figure with the former in N°. 1, 2.

For the Spaces generated by the Lines *E q*, *F C*, &c. will be as the Squares of their Diameters, or of the generating Lines. But 'tis certain, that the Square of *F h* or of *F C*, exceeds the Square of *F h*, by the Square of *h H* or *f F*; that is, by the Square of *E Q*, by the Suppoſition above; wherefore the Circle generated by the Motion of *F C*, will exceed that generated by *F H*, by that Circle generated by *E Q*. But the Space generated by *F C*, exceeds that generated by *F H*, by the Ring generated by *H C*; wherefore that Ring made by *H C* muſt be equal to the Circle made by *E Q*, *Q E D*. And this will always be ſo; and therefore the Line *H C* can never grow of any Length, and conſequently the Curve and the *Aſymptote* can never meet.

There are other *Aſymptotes* to other Curves; and though the *Parabola* hath no *Aſymptote*, yet two *Parabola*'s may be drawn aſymptotically to each other.

The following general Obſervations about *Aſymptotes* and *Aſymptotick Curves*, I had communicated from Mr. *Humphry Ditton*, late Maſter of the new Mathematical School in *Chriſt*'s *Hoſpital*, a Perſon peculiarly ſkilful in theſe Matters, and are as follows.

Some General Obſervations about Aſymptotes *and* Aſymptotical Curves.

I. Though it be certain that all ſuch Curves as have *Aſymptotes* be of the Number of thoſe which (running on *in Infinitum*) do not include a Space; yet it is not true, on the other Hand, that whereever we have a Curve of that Nature and Property, we find an *Aſymptote* alſo. For this infinite Continuation of the Curve is viſible in all thoſe of the Parabolick Family, and yet none of all theſe can have an *Aſymptote*; that is, not any Right-line placed in any Poſition to the Curve, which can infinitely approach to it, and yet not cut it, as is not hard to be demonſtrated.

II. Of thoſe Curves that have an *Aſymptote*, ſome there are that have two, others that have only one. Inſtances of the former Kind are all the ſorts of Hyperbolick Curves, which from the Principle of their Geneſis, as being formed from reciprocal Series, are eaſily proved to have two *Aſymptotes*. And of the latter ſort we have the *Conchoid*, the *Ciſſoid*, and the *Logarithmick Curve*, the Nature of which conſidered, as clearly ſhews that they have one and no more.

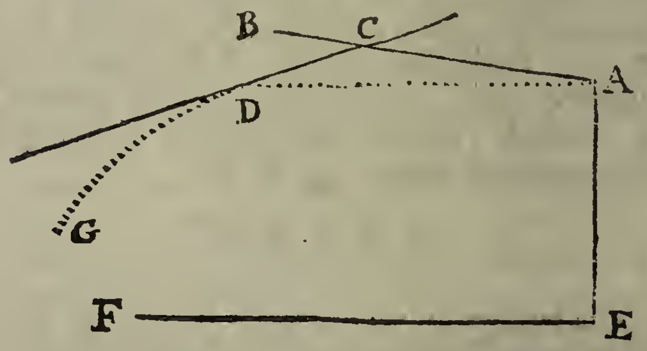
III. As a Right-line and a Curve may be aſymptotical to one another, ſo alſo may Curves and Curves; and here are two or three Varieties to be conſidered.

1. Any of theſe Curves that have from their own Nature and Conſtruction an *Aſymptote*, are capable of being aſymptotical to one another. Thus in Conick Sections 'tis demonſtrated, that *Hyperbola's* that have the ſame common *Aſymptote*, are alſo themſelves *Aſymptotes* to each other; and this ſhall afterwards be ſhewn univerſally of all ſuch Curves.

2. Not only thoſe Curves which are endowed with an *Aſymptote*, but even ſuch as in their own Nature admit of no ſuch thing, may alſo have this Affection. The *Parabola* (for Inſtance) we know has no rectilineal *Aſymptote* belonging to it; and yet two *Parabola's*, with their Axes placed in the ſame Right-line, will be aſymptotical to each other; as *De la Hire* has demonſtrated, *Sect. Conic. Lib.* 6.

3. But no Curve that has any *Aſymptote* belonging to it, can ever be aſymptotical to another whoſe Nature refuſes a rectilineal *Aſymptote*; for if it were ſuppoſed to be ſo, then this latter Curve would have the *Aſymptote* of the former Curve for its own *Aſymptote* too, which is contrary to the Hypotheſis of its having none at all. Thus, for Inſtance, a *Parabola* and an *Hyperbola* can never be aſymptotical to one another; for were it ſo, the *Aſymptote* of the *Hyperbola* would be alſo an *Aſymptote* to the *Parabola*; which is impoſſible, ſince that Curve can have no *Aſymptote*.

IV. No Right-line can ever poſſibly be an *Aſymptote* to a Curve that is every where concave towards that Right-line: This is very clear from the bare Conſideration of the Curvature, and the Tendency of it; and may be thus brought into Demonſtration.

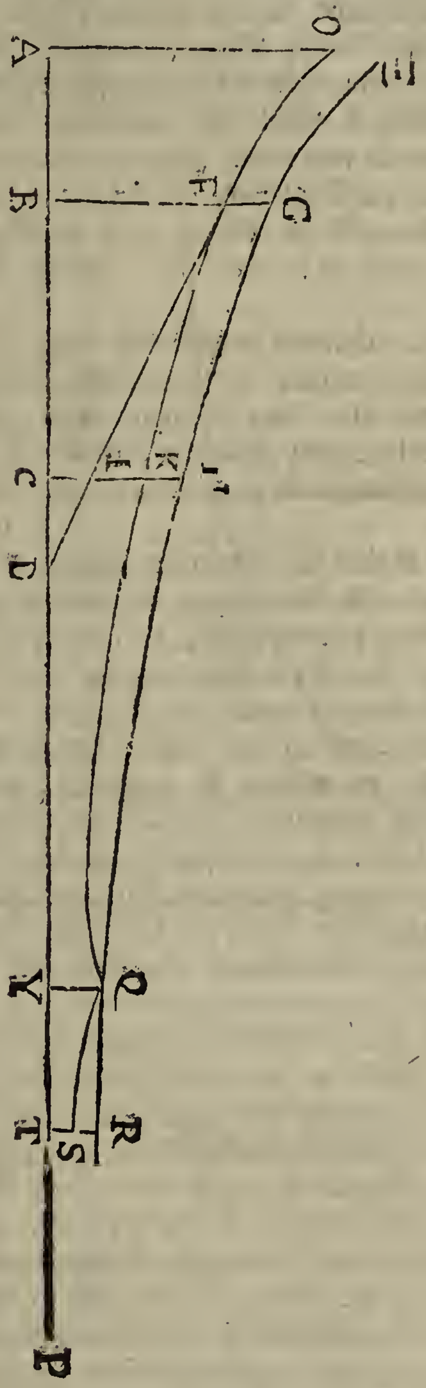


Let the Curve *A D G* (whoſe Ax is *A E*) be concave in all its Parts towards the Right-line *F E*; this Line then *F E*, ſhall never be an *Aſymptote* to the Curve *A D G*. Let *A B* touch the Curve in the Vertex *A*, and be imagined parallel to *F E*; then any other Tangent as *C D*, ſuppoſe ſhall, if it be produced, meet with *F E* in ſome Point or other; but becauſe *C D* is a Tangent, therefore the Curve Line it ſelf falls between the Tangent and the Line *F E*; but it is by the Hypotheſis alſo concave to all its Parts; therefore if the Tangent *C D* produced, interſects *F E a fortiori*, the Curve *C D G* ſhall meet with it alſo; and therefore *F E* is not an *Aſymptote*.

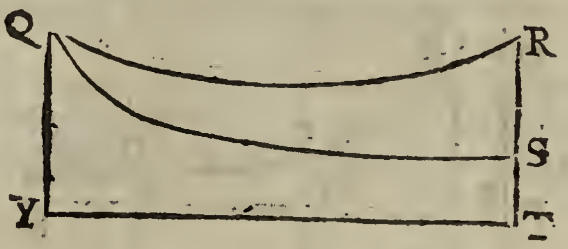
V. But a Right-line may be an *Aſymptote* to a mixt Curve that is partly concave and partly convex towards the ſame Line. An Inſtance of this we have in the *Conchoid* of *Nicomedes*, which is concave (for ſome Parts of it) to its *Normal*, and then after the *Punctum Flexus*, in which 'tis neither concave nor convex, it is for ever convex towards the ſame. Concerning which *Punctum Flexus*,

Flexus, ſee *Schoten Comment. upon Cart. Geometry, lib.* 2.

VI. All Curves that have one and the ſame common *Aſymptote*, are alſo aſymptotical to one another.

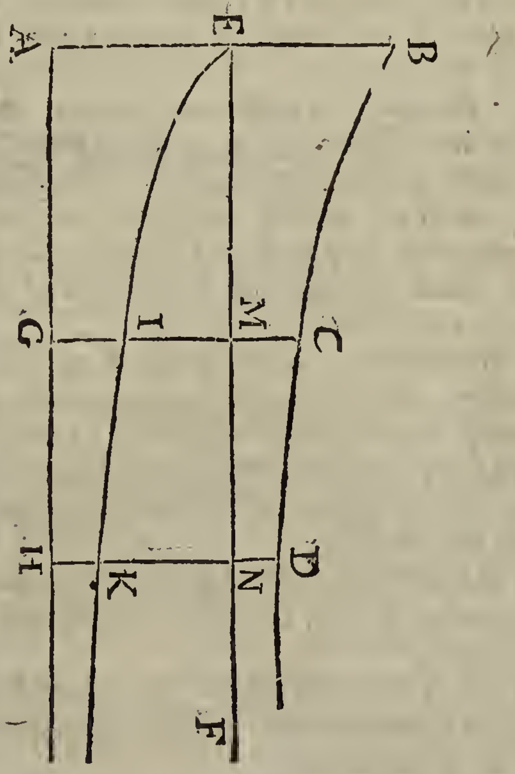


Let the Curves *E G H*, *O F K*, have the common *Aſymptote A D P*; then they ſhall be aſymptotical to each other. Firſt of all it is evident, that they continually approach to one another; for Inſtance, drawing the Line *F D* a Tangent to the Curve *O K* in *F*, to meet with the Aſymptote in *D*, and producing *B F* to *G* in the Curve *E H*, draw *G H* a Subtenſe in that Curve parallel to *F D*; and then from *H*, the Line *H K C* parallel to *G B*; 'tis clear, that $FG = HI$, and $HI \lrcorner HK$, becauſe *F D* touches in *F*; therefore $FG \lrcorner HK$, that is, the Curves are nearer to one another in the Points *H K*, than in *F G*; and the ſame may be ſhewn of any other Points taken from the Parts of *B*, *C*, towards *P*. But then again, theſe Curves can never poſſibly meet with, or cut one another. For imagine they could, and did interſect each other at the Point *Q* ſuppoſe; and let *Q Y*, *R T* be parallel to *B G*, *H C*. The Curve *O K F* goes above the Curve *E G H* (after the Interſection in *Q*) into *R* ſuppoſe, and the other falls below, as ſuppoſe at *S*. Now if two Curves as *Q R*, *Q S*, cut in *Q* the Curve *Q R* departing from *Q S*, 'tis plain that ſome Point, as *R*, may be taken in the Curve *Q R*, from whence a Right-line, as *R T*, drawn to another Line, as *Y T*, ſhall be equal to *Q Y*, the Line from *Q*, the common Section of the Curves to the ſame Line *Y T*. This follows from the Nature of Curve-lines in general.



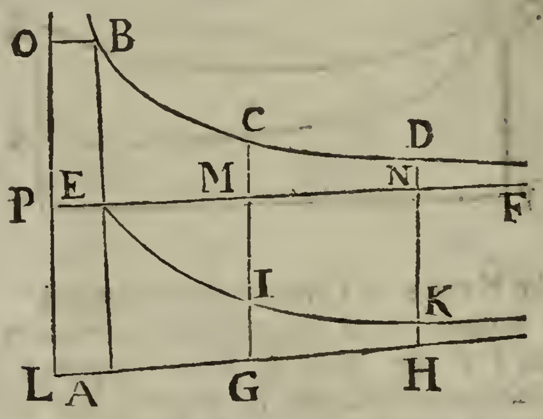
Now let us ſuppoſe theſe Curves that cut thus to have the Line *Y T* for their common *Aſymptote*; then from the general Nature of Curves, we can find the Point *R*, from whence *R T* ſhall be $= QY$, but upon the Hypotheſis that *Y T* is an *Aſymptote*, 'tis impoſſible that *R T* ſhould be $= QY$, for the Lines intercepted between the Curve and its *Aſymptote*, are ſtill leſs and leſs, and therefore *R T* muſt be leſs than *Q Y*, becauſe of the *Aſymptote*; and from hence it is certain, that two Curves, which have one and the ſame *Aſymptote*, can never cut each other.

VII. Two equal Curves of the ſame Sort, whoſe *Aſymptotes* are parallel with themſelves, be equidiſtant in all their Points. Theſe Curves are ſuppoſed to be ſuch as have but one *Aſymptote* a-piece.



Let *E F* be the *Aſymptote* of the Curve *B C D*, and *A H* the *Aſymptote* of the Curve *E I K*; and the Curves being by the Hypoth. of the ſame Kind and equal, therefore $EB = EA$, and $IG = CM$, and $DN = KH$, and $IG + IM = CM + IM$; and ſo $DN + NK = KH + NK$; but $KH + NK = IG + IM$ (for *E H* is a Parallelogram) therefore $CM + IM = DN + KN$, that is, $CI = DK$; and ſo in all other Points from whence the Curves are equi-diſtant.

VIII. The ſame thing is true alſo of equal Curves of the ſame Sort that have two *Aſymptotes* each, but with a Limitation. Suppoſe *L O* to be one common *Aſymptote* to both Curves, and *P N* the other for the Curve *B C D*, as *L H* is for the Curve *E I K*; where the lower Curve cuts the *Aſymptote* of the upper in *E*, drawing *B E A* parallel to *O L*; 'tis evident that from the Points *B* and *E* to the Parts of *D* and *K* infinitely, the Curves are equi-diſtant from one another: For by the Hypotheſis, the Points P and L are the Concourſes of the *Aſymptotes*, and $P\,E$ being $= L\,A$,



$B\,E$, $C\,M$, $D\,N$, are ever $= E\,A$, $I\,G$, $K\,H$, &c. from whence the Concluſion follows as before.

ASYNDETON, ['Ἀσύνδετον, of *α priv.* and συνδέω, *Gr. to bind together*,] is a Figure in *Grammar*, implying a Defect or Want of Conjunctions in a Sentence (as *Polyſyndeton* is a Redundancy of them) as in this Inſtance, *Græculus eſuriens, in Cælum juſſeris, ibit*; where the *ſi* before *juſſerit* is omitted.

ASYSTATON, ['Ἀσύστατον, *Gr.*] a trifling inconſiſtent Story that does not hang together, but contradicts itſelf.

ATCHIEVEMENT, [*Achevement*, of *acheter*, *F. to obtain*,] in *Heraldry*, ſignifies the Coat of Arms of any Gentleman duly marſhalled with Supporters, Helmet, Wreath and Creſt, and with Mantles and Woods; or, as the Heralds call it, with *Heaulme* and *Timbre*, *i. e.* with *Helmet* and *Creſt*. Such are uſually hung out on the Fronts of Houſes after the Death of the Lord, Lady, Maſter, or ſome conſiderable Perſon; and are now corruptly call'd Hatchments.

ATHANOR, a Kind of digeſting Furnace in Chymiſtry, fix'd and large, and made with a Tower, which is contrived ſo as to keep a conſtant Heat for 14 Days, a Month, *&c.* or the Heat may be increaſed or diminiſhed at Pleaſure, by opening or ſhutting the Regiſters.

ATHARER, [in *Aſtrology*,] a Term uſed of the Moon, when it is in the ſame Degree and Minute with the Sun.

ATHENATORIUM, [in *Chymiſtry*,] is a thick glaſs Cover or Head fixed to a Cucurbit in ſome Kinds of Sublimations.

ATHEROMA, ['Ἀθήρωμα, *Gr.*] a Sort of Tumour or Swelling conſiſting of a thick and tough Humour like Pap, contain'd in a Bag or membranous Coat. It neither cauſes Pain, nor changes the Colour of the Skin. It doth not eaſily yield to the Touch, nor leaves any Dint after it is compreſſed.

ATHYMIA, [Ἀθυμία, of *α priv.* and θυμὸς, *Gr. the Mind*,] is a Dejection or Anxiety of Mind.

ATLANTES, [*Architecture*,] certain Images of Men bearing up Pillars, or ſupporting the Pile of a Building.

ATLAS, [in *Anatomy*,] is the firſt *Vertebra* of the Neck under the Head; ſo called becauſe it ſeems to hold up the Head: It wants Marrow.

ATMOSPHERE, ['Ἀτμοσφαῖρα, of ἀτμὸς *a Vapour*, and σφαῖρα, *Gr. a Sphere*,] is the lower Part of the Region of the Air or *Æther*, with which our Earth is encompaſſed all round; and up into which the Vapours are carried, either by Reflection from the Sun's Heat, or by being forced up by the ſubterranean Fire.

The Preſſure of the *Atmoſphere*, Mr. *Boyle* undertakes to demonſtrate from many Experiments: As,

1. That two poliſhed Marbles of about three Inches Diameter, and which would in the open Air ſuſtain a Weight of 80 *lb.* before they would fall aſunder, would, in the exhauſted Receiver, fall aſunder with a Pound, and ſometimes with half a Pound Weight. Nay, though when the Receiver was evacuated, the upper Marble being let down to touch the other, it would by no Means adhere to it; yet when this was tried after the Re-admiſſion of the Air into the Receiver, the Marbles then, on their being brought to touch each other, would as ſtrongly adhere as at the firſt. *Hiſtory of Firmneſs, p.* 288.

The Height of the *Atmoſphere* is variouſly conjectured: *Kepler* makes it about eight Miles; but other eminent and later Aſtronomers, eſpecially the learned and diligent *Ricciolus*, makes it probable, that the *Aſmoſphere* may be at leaſt fifty Miles high.

Mr. *Boyle* makes the common Height of the *Atmoſphere*, when the Mercury in the Baroſcope is at 30 Inches, to be 35000 Foot, or ſeven Miles; but this Account is upon a Suppoſition, that all our Air is of the ſame Denſity or Weight, from the Surface of the Earth to the Top of the *Aſmoſphere*; which can by no Means be ſuppoſed; and therefore he rightly concludes it muſt be much more. Nay, in his Book againſt *Linus*, he ſuggeſts, that 'tis probable it may be ſome Hundred, and even Thouſands of Miles high, in Caſe the *Atmoſphere* be not a bounded Portion of the Air, but reach as high as it.

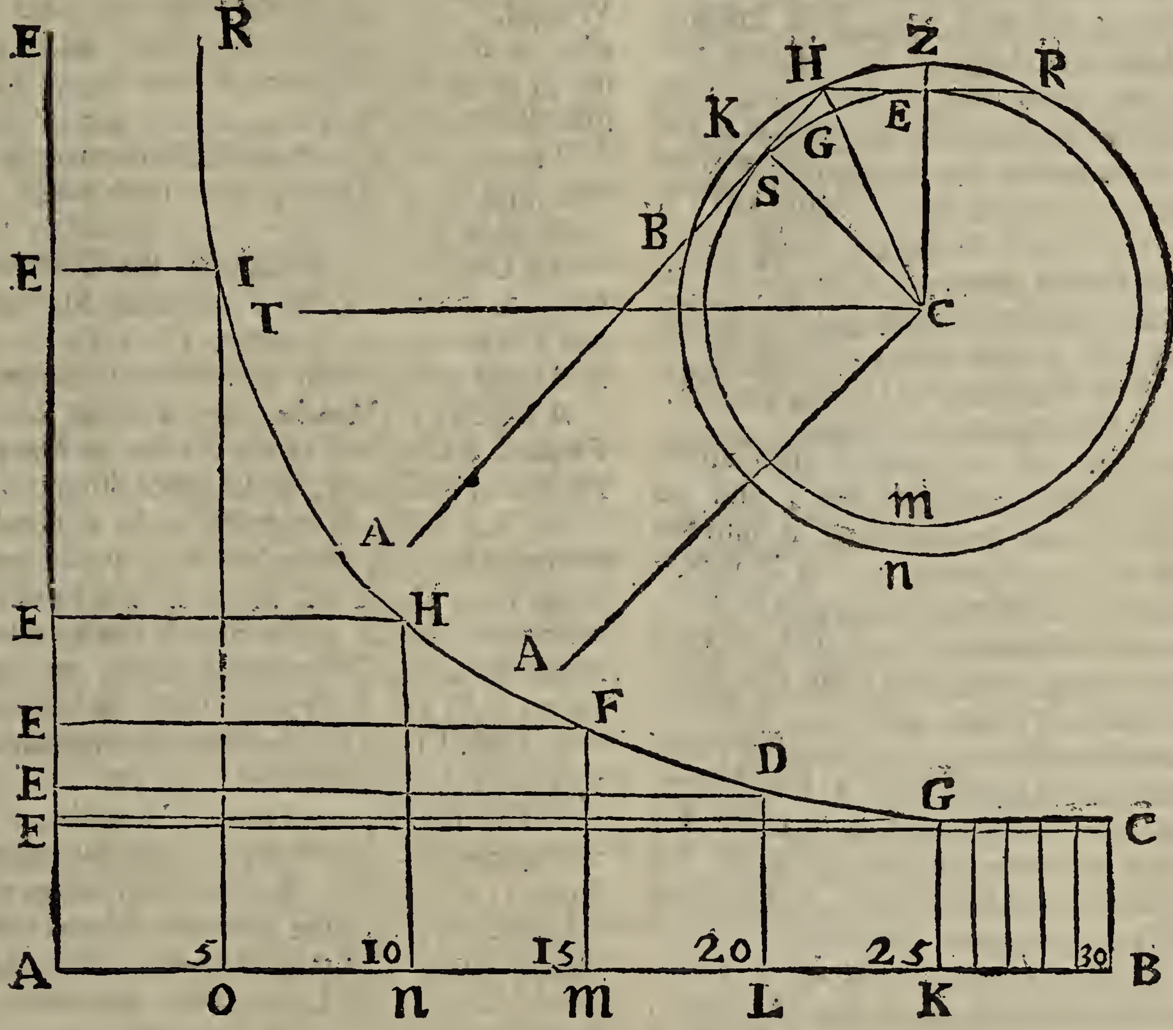
The ſame Honourable Philoſopher got a hollow Cylinder of Braſs to be exactly turned by a good Artiſt, whoſe Length was three Inches, and the Diameter of its Bore juſt an Inch: This had a Bottom nicely fitted to it; and then being filled with Quickſilver (the Weight of the Cylinder being before known) it held as much as weighed 17 *Oz.* 1 Drachm, 45 gr. *Troy*. This being multiplied by 10 (becauſe the Baroſcope then ſhewed the Mercury to be at 30 *gr.*) gave 14 *lb.* 2 *oz.* and above 3 *drachms Troy*, for the Weight of a Column of Mercury of an Inch in Diameter, and 3 Inches in Length. And ſo much conſequently was the Weight of a Column of Air of an Inch in Diameter, and of the whole Height of the *Atmoſphere*.

Hence, knowing the Proportions of Cylinders, (*which ſee under* Cylinder) 'tis eaſy to calculate the Weight of a Cylinder of Mercury, and conſequently of Air to the Top of the *Atmoſphere*, of any given Diameter. For as 1. the Square of the Diameter of the Cylinder above-mentioned, is to the Square of the given Diameter of the Cylinder ſought (which, if it were two Inches Diameter, will have its Square 4) : : So is the Weight of the Cylinder above-mention'd, to the Weight of that ſought. Work as in the *Rule of Three*, and you have your Deſire.

In Mr. *Boyle*'s Deſcription of his *Statical Baroſcope*, he tells us, That he found a Pillar of Air incumbent on a ſquare Inch, to weigh 18 *lb.* ½ *Troy*. From which Account I calculated the Weight of the whole Air, all round the Globe, to be 8.99040573220800000 Pounds *Troy*, which agrees nearly with the Weight of it calculated by Mr. *Paſchal* (tho' he proceeded a very different way) for he makes it to be 8.28388944000000000.

Mr. *Halley*, by undoubted Experiments found, that the Weight of Mercury to Water, is as $13\frac{1}{2}$ to 1, or very near it; and that the ſpecifick Gravity of Air to Water, is as 1 to 800, ſo that the Weight of Mercury to Air, is as 10800 to 1; and a Cylinder of Air of 10800 Inches, or 900 Feet, is equal to an Inch of Mercury; ſo that were the Air of an equal Denſity like Water, the whole *Aſmoſphere* would be no more than $5\frac{1}{10}$ Miles high; and in the Aſcent of every 900 Feet, the Barometer would ſink an Inch. But the Expanſion of the Air increaſing in the ſame Proportion as the incumbent Weight of the *Atmoſphere* decreaſes, that is, as the Mercury in the Barometer ſinks, the upper Parts of the Air are much more rarified than the lower, and each Space anſwering to an Inch of Quickſilver, grows greater and greater; ſo that the *Atmoſphere* muſt be extended to a much greater Height.

To determine the Height of the Mercury at any aſſigned Height of the Air; or having that given, to find the Height of the Place where the Barometer ſtands.



Since the Expanſion of the Air is reciprocally as the Height of the Mercury; it is evident, that by the Help of the Curve of the *Hyperbola*, and its *Aſymptote*, the ſaid Expanſions may be expounded to any given Height of the Mercury.

For by the 65th *Prop. lib.* 2. *Conic. Mydorgii*, the Rectangles *A B C E*, *A K G E*, *A L D E*, &c. are always equal; and conſequently the Sides *C B*, *G K*, *L D*, &c. are reciprocally as the Sides *A B*, *A K*, *A L*, &c. If then the Lines *A B*, *A K*, *A L*, be ſuppoſed equal to the Heights of the Mercury, or the Preſſures of the Atmoſphere; the Lines *C B*, *K G*, *L D* anſwering thereto, will be as the Expanſions of the Air under thoſe Preſſures, or the Bulks that the ſame Quantity of Air will occupy; which Expanſions being taken infinitely many, and infinitely little (according to the Method of Indiviſibles) their Sum will give the Spaces of Air between the ſeveral Heights of the Barometer, *viz.* the Sum of all the Lines between *C B* and *K G*, or the Area *C B K G* will be proportioned to the Diſtance or Space intercepted between the Levels of two Places in the Air where the Mercury would ſtand at the Heights repreſented by the Lines *A B*, *A K*; ſo then the Spaces of Air anſwering to equal Parts of Mercury in the Barometer, are as the Areas *C B K G*, *G K L D*, *D L F M*, &c. But theſe Areas are proportionate to the Logarithms of the Numbers expreſſing the Rationes of *A K* to *A B*, of *A L* to *A K*, of *A M* to *A L*, &c. as was demonſtrated by *Gregory St. Vincent*; ſo then, by the common Table of Logarithms, the Height of any Place of the Atmoſphere, having any aſſigned Height of Mercury, may moſt eaſily be found; for the Line *C B* in the Hyperbola, whereof the Areas deſign the Tabular Logarithms, being 0,0144765; 'twill be as 0,0144765, to the Difference of the Logarithm of 30, or any other leſſer Number, ſo 900 Feet, or the Space anſwering to an Inch of Mercury, if the Air were equally preſs'd with 30 Inches of Mercury, and every where alike to the Height of the Barometer in the Air, where it will ſtand at the leſſer Number of Inches: And by the Converſe of this Proportion may the Height of the Mercury be found, having the Altitude of the Place given.

Upon theſe Suppoſitions it will appear, that at the Height of 41 Miles the Air is ſo rarified, as to take up 3000 Times the Space it occupies here; and at 53 Miles high, it would be expanded above 300000 times; but 'tis probable, that the utmoſt Power of its Spring cannot exert itſelf to ſo great an Extenſion, and that no Part of the Atmoſphere reaches above 45 Miles from the Surface of the Earth.

This is further confirmed from the Obſervations of the *Crepuſculum*, which is obſerved commonly to begin and end when the Sun is 18 Degrees below the Horizon; for ſuppoſing the Air to reflect Light from its moſt rarified Parts, and that as long as the

Sun illuminates any of its Atoms, they are viſible to an Eye not intercepted by the Curvity of the Earth; it will follow, that the Proportion of the Height of the whole Air, to the Semi-diameter of the Earth, is much about, as 1 to 90, or as the Exceſs of the Secant of about 8 1 half Degrees to the Radius. For if *E* be the Eye of the Obſerver, *S* a Place where the Sun ſets at the End of Twilight in *E*, and the Ark *E C S*, or *T C A*, be found 18 Degrees, the Exceſs of the Secant of half thereof *ECH*, would be the Height of the Air, *viz.* *G H.* But the Beam of the Sun *A S H*, and the viſcid Ray *E H*, do each of them ſuffer a Refraction of about 32 or 33 Minutes, whereby being bent inwards from *H* towards *G*, the Height of the Air need not be ſo great as if they went ſtrait; and having from the Angle *E C S* taken the double Refraction of the horizontal Ray, the half of the Remainder will be 8 1 half Deg. *circiter* whoſe Secant being 10111, it follows, that as 10000 to 111, ſo is the Semi-diameter of the Earth, ſuppoſed 4000 Miles, to 44,4 Miles, which will be the Height of the whole Air, if the Places *E S*, whoſe viſible Portion of the Atmoſphere *E R Z H*, and *S H K B* juſt touch one the other, be 18 Degrees aſunder.

At this Height the Air is expanded into above 3000 times the Space it occupies here; and we have ſeen the Experience of condenſing it into the 60th Part of the ſame Space; ſo that it ſhould ſeem, that the Air is a Subſtance capable of being compreſs'd into the 180000th Part of that Space it would naturally take up when free from Preſſure.

ATMOSPHERE. From what has been already ſhewn under this Word, it appears to be plainly impoſſible to account for ſo great a Rarefaction and Condenſation, as is diſcovered to be in the Atmoſpherical Air, without the Suppoſition of the Particles of Matter being endued with a Repelling or Levitating Force, whereby they mutually avoid one another, till they come within the Diſtance where the Attractive Force begins. See *Attraction.* For as the learned Mr. *Halley* obſerves, at the Cloſe of his Propoſition about the Heights of the Mercurial Cylinder, at any Elevation above the Earthy Surface, ſee *Phil. Tranſ. N.* 187, it ſeems a *very hard Queſtion, that the Texture or Compoſition of Parts can be* capable of ſo great an Expanſion and Contraction as is found to be in the Air, and can ſcarce be accounted for, from comparing it to *Wooll*, or ſuch like ſpongy Bodies.

ATMOSPHERE *of conſiſtent Bodies:* The honourable Mr. *Boyle* hath written a ſmall Eſſay on this Subject, in which he proves that very many, and therefore probably all *ſolid*, *firm*, and *conſiſtent Bodies*, (*i. e.* ſuch as are not fluid) have, at ſome certain Times (at leaſt) *Effluvia* of Particles of Matter which exhale from them: For he found, that many ſuch Bodies would in a little Time be very ſenſibly diminiſhed in Weight: That ſome *Electrical Bodies*, as Amber and Glaſs, would exert *that Property* uniformly all round them when they were heated; which they uſually exhibit upon rubbing or chafing, *viz.* that of attracting ſmall Bodies to them: That Glaſs, Stones, and hard Metals, would, on being rubb'd one againſt another, ſtrongly emit not only ſenſible, but even offenſive Odours, *&c.*

ATOCIUM, [Ατοκιον, of *α neg.* and *τίκτω*, *Gr. to bring forth*,] any Medicament that prevents Conception or Birth.

ATOME, [’Ατομος, of *α neg.* and *τέμνω*, *Gr. to cut*,] is ſuch a very ſmall Particle of Matter, that it cannot phyſically be cut or divided into leſſer Parts: *Epicurus*, and his Sect of Philoſophers, firſt called the component Principles of all Bodies, which they ſuppoſed to be infinitely ſmall and hard, by this Name of *Atoms*. Theſe *Atoms* may be ſuppoſed to have theſe four inſeparable Properties; 1. That they are all of the ſame Nature, Subſtance, or Matter; for all Matter abſtracted from Form is the ſame. 2. That they have all ſome Magnitude or Quantity; for they are not indiviſible Points, but Phyſical Bodies of ſome (though ſmall) determinate Bulk. 3. They have alſo all of them ſome determinate Figure or Shape. And 4. They muſt have alſo, each of them, ſome real Gravity or Weight. To theſe *Sextus Empiricus* adds ’Αντιτυπία, or *Retinency*; but this rather may be ſuppoſed to be the Conſequence of their being ſolid and inſectile, which they are, as they are *Atoms.*

The original Qualities of *Atoms* can only be their Size and their Figure, and theſe taken together make their Form.

ATOMICAL *Philoſophy*, the Doctrine of *Atoms*, or the Method of accounting for the Origin and Formation of all things, from the Suppoſition of Atoms endued with *Gravity* and *Motion.*

ATONY, [’Ατονία, *Gr. a Want of Tone or Tenſion, a Weakneſs in the Nerves or Sinews*,] is a Faintneſs, Infirmity, or Want of Strength.

ATRA *Bilis*, is ſuppoſed to be a Kind of ſulphureous terrene, and aduſt Salt, which being bred in the Body (ſome will needs have it in the Spleen) is circulated about in the Blood, and by that Means makes an undue Fermentation in it, and is the Occaſion of Melancholly, and ſuch like Diſtempers.

ATRETUS, is one whoſe Fundament or privy Parts are not perforated.

ATROPHY, or *Tabes*, [’Ατροφία, of *α priv.* and *τρέφω*, *Gr. to nouriſh*,] a Conſumption ariſing from Want of Nouriſhment, and when either the whole Body, or ſome particular Limb, withers and decays away. Though *Tabes* is often taken only for an Ulcer in the Lungs, from whence the whole Body by Degrees decays and periſhes.

ATTACHIAMENTA *Bonorum*, a Diſtreſs taken upon the Goods or Chattels of any one ſued for perſonal Eſtate or Debt by the legal *Attachiators* or Bailiffs, as a Security to anſwer the Action.

ATTACHIAMENTA *de Spinis & Boſco*, is the Privilege granted to the Officers of a Foreſt to take to their own Uſe Thorns, Bruſh and Windfall, within ſuch Precincts or Liberties committed to their Charge.

ATTACHMENT, [in *Law*,] is a Taking or Apprehending by Command or Writ: It differs from an *Arreſt* in this, that an *Arreſt* lies only upon the Body of a Man, whereas an *Attachment* is ſometimes on the Goods only, and ſometimes on Body and Goods.

ATTACHMENT *of Privilege*, either gives Power to apprehend a Man in a Place privileged, or by Virtue of an Office or Privilege, to call another into that Court whereunto himſelf belongeth.

ATTACHMENT *Foreign*, is a Proceſs which is uſed to attach the Goods of Foreigners found within the Liberty or City, for a Debt due to the Party himſelf.

ATTACHMENT *of the Foreſt*, is a Court held there every forty Days throughout the Year.

ATTACK *of a Siege*, [in the *Art of War*] is the Effort made by the Beſiegers with Trenches, Mines, Galleries, and Breaches, in order to make themſelves Maſters of a Fortreſs in ſtorming one of its Sides.

ATTACK *Falſe*, is that which is not vigorouſly proſecuted, ſerving only to make a Diverſion among the Beſieged, and to oblige them to divide their Forces, that the true Attack may be carried on with greater Succeſs.

To ATTACK *in Flank*, is to attack both Sides of the Baſtion.

To gain a Place by right Attack, is to carry it by formal Attack and regular Works, without a general Storm.

ATTAINDER, [*Attaindre*, *F.*] is when a Man hath committed Felony or Treaſon, and Judgment is paſſed upon him. The Children of a Perſon attainted of Treaſon cannot be Heirs to him, or any other Anceſtor; and if he were noble and gentile before, thereby his Poſterity are degraded and made baſe; and this Corruption of Blood cannot be ſalved but by an Act of Parliament, or unleſs the Judgment be reverſed by Writ of Error.

ATTAINDER, [in *Law*,] is threefold, either by *Battle*, by *Confeſſion*, or by *Verdict*.

ATTAINDER *by Battle*, is when the Party appealed by another, rather chuſes to try the Truth by Combat than by Jury, and is vanquiſhed.

ATTAINDER *by Confeſſion*, is either by pleading Guilty at the Bar before the Judges, and not putting himſelf upon Trial by the Jury; or before the Coroner in Sanctuary, where in ancient times he was obliged to renounce the Realm.

ATTAINDER *by Verdict*, is when the Priſoner at the Bar pleads *Not guilty* to the Indictment, and is pronounced guilty by the Jury.

ATTAINDER *by Proceſs*, is otherwiſe called *Attainder by Default*, or *Utlary*, and is where a Perſon flieth and is not found, after he hath been three times publickly called in the Country, and at laſt is outlawed by Default.

ATTAINT, [*Atteint*, *F.*] in *Law*, is a Writ that lies where a falſe Verdict is given by 12 Men, which, if found to be a falſe Verdict, the 12 Men are *attaint*, and the Verdict ſhall be, that their Meadows ſhall be plough'd up, their Houſes broken down, their Woods turned up, and their Lands and Tenements forfeited to the King. But if it paſs againſt him that brought that *Attaint*, he ſhall be impriſoned, and grievouſly ranſomed at the King's Will.

ATTAQUES: See *Attact*.

ATTENDANT, [in *Law*,] is uſed in this Senſe, for one that oweth a Duty or Service to another; or after a Sort dependeth upon another, *v. gr.* There is a Lord, Meſne and Tenant; the Tenant holdeth of the Meſne by a Penny; the Meſne holdeth over by two Pence; the Meſne releaſeth to the Tenant all the Right he hath in the Land, and the Tenant dies: Then ſhall his Wife be endowed of the Land, and be *Attendant* to the Heir of the third Part of the Penny, and the third Part of the two Pence, for ſhe ſhall be endued of the beſt Part of the Poſſeſſion of her Husband. They ſay alſo, that where the Wife is endowed by the Guardian, ſhe ſhall be *attendant* to her Heir at his full Age.

ATTENTION, is regiſtring in the Memory thoſe Trains of Ideas which continually offer themſelves to the Mind, and are taken Notice of.

ATTENUATING *Medicines*, [*Attenuantia*, *L.*] are thoſe things which opening the Pores with their acute Particles, cut the thick and viſcous Humours in the Body into ſuch ſmall Particles as that they may eaſily be circulated through the Veſſels; and ſo there is made by Degrees an ATTENUATION, or leſſening of the Power or Quantity of the morbifick Matter.

ATTICK, [in *Architecture*,] the Name of a Baſis, which the modern *Architects* have given the *Dorick Pillar*.

ATTICK, [with *Engliſh Architects*,] a ſmall Order placed on a larger, having only Pilaſters of a particular Form inſtead of Pillars.

ATTICK *Architecture*, a Kind of Building uſed in *Athens*, where there is no Roof or Covering to be ſeen.

ATTICK *Order*, [*Architecture*,] a ſort of ſmall Order raiſed upon another that is larger, by Way of crowning, or to finiſh the Building.

ATTICK *Baſe*, [*Architecture*,] a peculiar kind of Baſe uſed by ancient *Architects* in the *Dorick*.

ATTICK *of a Roof*, [*Architecture*,] a Sort of Parapet to a Terraſs, Platform, *&c.*

ATTICK *continued*, [*Architecture*,] is that which encompaſſes the whole Pourtour of a Building without Interruption, following all Jetts, the Returns of the Pavilions, *&c.*

ATTICK *interpos'd*, [*Architecture*,] is that which is ſituate between two tall Stones, and ſometimes adorned with Columns and Pilaſters.

ATTIRE, [*Attour*, *F.*] the Heralds call the Horns of a Stag or Buck his *Attire*.

ATTIRE, [in *Botany*,] ſignifies, according to Dr. *Grew*, the third Part belonging to the Flower of a Plant; of which the two former are the *Empalement* and the *Foliation*. This *Attire* he finds to be of two Kinds, *Seminiform* and *Florid*; the *Semini-form Attire* conſiſts of two Parts; *Chieves* (or the *Stamina*, as ſome call them) and *Semets* or *Apices*, one upon each *Attire*. The *Florid Attire* is uſually called *Thrums*, as in the Flowers of *Marigold*, *Tanſey*, &c. Theſe *Thrums* the Doctor calls *Suits*, which conſiſt of two, but moſt times of three Pieces; the outer Part of the *Suit* is the *Floret*, whoſe Body is divided at the Top like a *Cowſlip* Flower, into five Parts or diſtinct Leaves.

ATTITUDES, [in *Painting*, *Statuary*, &c.] the Poſture of Figures or Statues; or the Diſpoſition of their Parts, by which the Action they are engaged in may be diſcovered, and alſo the very Sentiments ſuppoſed to be in their Minds.

ATTOLLENS *Auriculam*, is a Muſcle which conſiſts of divers fleſhy Fibres, and is annexed to that part of the *Pericranium* that covers the temporal Muſcle, whence it deſcends directly to its Implantation at the ſuperior Part of the ſecond Wrinkle of the Cartilage of the Ear. Its Name ſhews its Uſe.

ATTOLLENS *Oculos*, or *Superbus*, one of the ſix pair of Muſcles that belong to the Eye, ſerving to lift them upwards.

ATTOLLENS *Nares*, a Muſcle of the Noſe, whoſe Name ſhews its Uſe.

ATTOLLENTES, are a pair of Muſcles, which acting both together, draw all the upper Lip directly upward and outward; but if only one, then one Side of the Lip is drawn obliquely.

ATTONITUS, *Stupor*, *ſeu Morbus attonitus*: See *Apoplexy*.

ATTORNATO *faciendo vel recipiendo*, is a Writ which a Man owing Suit to a Country Hundred, Wapentake, or other Court, and deſiring to make an *Attorney* to appear for him, whom he doubteth whether the Sheriff or Bailiff will admit or not, purchaſeth to command him to receive and admit him.

ATTOURNMENT, [in *Law*,] is when one is Tenant for Term of Life, and he in Reverſion or Remainder grants his Right or Eſtate to another, then it behoves the Tenant for Life to agree thereto; and this Agreement is called an *Attournment*.

ATTRACTING, or *Drawing Medicines*, or *Things*, are thoſe, which opening the Pores with their little Particles, and dilating the Humours and expelling them, where their Reſiſtance is ſmaller, not only ſhews the Parts, and makes them red, but by driving more Vapours and Humours out of the Skin and Fleſh, than can make their Way through the thick inner Skin, gather them under it, and ſwell it into little Bladders.

ATTRACTION, is the drawing of one thing to another. Whether among the Operations of Natural Bodies one upon another, there be any ſuch thing as *Attraction*, properly ſo ſpeaking, is a Queſtion that hath been much debated amongſt Philoſophers; and perhaps moſt of thoſe Effects which the Ancients, not knowing ſo well the Cauſes of, did uſe to attribute to *Attraction*, may now be very well ſolved by *Pulſion*. See *James Bernouilli, de Gravitate Ætheris. Amſterdam* 1683, in 8°. However, the Word is retained by good Naturaliſts, and in particular, by the excellent Sir *Iſaac Newton*, in his *Principia*; but without there determining any thing of the *Quale* of it, for he doth not conſider things ſo much *Phyſically*, as *Mathematically*. This therefore being premiſed, he lays it down as an *Axiom*, That ſince *Action* and *Re-action are always equal and directly contrary to each other*; therefore if any thing attract another, it is itſelf alſo as much attracted by that other thing; taking Attraction in the largeſt and moſt general Senſe, for the *Conatus* of one Body towards another, however it be cauſed.

That there is ſuch a thing as *Attraction* in Bodies, appears from the following Experiments.

1. We ſee that in all Liquors all the Parts attract one another, from the ſpherical Figure that the Drops always have, and alſo becauſe there is no Liquor whoſe Parts are not ſticking to one another, which is evidently true even in Mercury itſelf.

2. But this mutual Attraction of Particles is much better proved; becauſe in all Liquids, two Drops, as *A* and *B*, (*Fig.* 6.) as ſoon as they touch one another ever ſo little, they immediately run into one larger Drop, as *F*; all which things, as they alſo happen in liquified Metals, it follows, that the Parts of which they are compounded do attract one another, even when they are disjoined by the Motion of the Fire.

Theſe Appearances do not depend upon the Preſſure of the Air, becauſe they alſo happen where there is no Air; nether do they depend upon the Preſſure of any other Matter equally from all Sides; for though ſuch a Preſſure is able to keep the Drops to their ſpherical Figure, it can by no means bring them to it at firſt.

In the oval Drops *a c b d* (*Fig.* 7.) the Preſſures upon the Surfaces *a d* and *c b*, are leſs than the Preſſures upon the Surfaces *a c*, *d b*; for the Drop is ſuppoſed to be preſſed equally from all Parts, therefore the Preſſure is leſs in a leſs Space; yet the Drop can never become round, till thoſe leſſer Preſſures overcome the greater, which is abſurd.

On the contrary, in *Attraction*, the greater the Number is of the Particles which attract one another between two Particles, the greater is the Force with which they are carried towards one another; which produces a Motion in the Drop, till the Diſtances between the oppoſite Points in the Surface become every where equal, which can only happen in a ſpherical Figure.

Several Bodies act upon other extraneons Bodies by this Attraction. I ſhall give a few Examples, in which the Effects of it are moſt remarkable.

3. Immerge in Water the Ends of ſome Glaſs Tubes open at both Ends, in the Manner repreſented in *Fig.* 8. the Water will ſpontaneouſly aſcend in them, and ſo much the higher as the Diameter is leſs. It is not required that the Tubes be extreamly ſmall; for the Experiment will ſucceed in Tubes whoſe Bore is the ſixth Part of an Inch; that this is not to be attributed to the Preſſure of the Air, appears from the following Experiment.

4. Having fixed ſome ſmall Tubes in a Piece of Cork, and ſuſpended them with a braſs Wire *A B*, (*Fig.* 9.) pump out the Air from the Recipient *R*, which ſtands upon the braſs Plate of the Air-pump; then by moving the Wire *A B*, the Tubes may be immerged in the Water which is contained in the Glaſs *C D*, and the Water in this Caſe will riſe up into the Tubes juſt as it did in the foregoing Experiment. How the Wire may be moved without letting the Air into the Recipient, will be explained hereafter.

5. *A B C D* (*Fig.* 13.) are two glaſs Plates or Planes, touching one another at *A B*, but a little ſeparated at *C D*, by thruſting a thin Plate of any Kind between them; they are ſuſtained by the wooden Frame *H I L M*, in ſuch Manner that the Side *D C* is always at the ſame Height; the Planes may be brought to make any Angle with the Horizon, by raiſing the End *A B* where they are joined, the Cylinder *N O* likewiſe ſuſtaining the Plane in any Poſition. The Screw *P* makes faſt the Cylinder at any Height.

A Drop of Water of Oil, *G*, is put between the Planes, ſo as to touch both the Planes, which muſt before-hand be made wet with the ſame Liquor; this Drop is attracted by both Planes, but the Attraction has a greater Effect upon the Drop where this Diſtance is the leſs; that is, a greater at *e* than at *f*, therefore the Drop is mov'd towards *e*; that is, aſcends, and moves upwards the faſter in Proportion, as it is higher; the Surfaces in which the Drop touches the Glaſſes growing very much where the Diſtance between the Planes is diminiſhed. The Angle of Inclination of the Planes may be ſo increaſed, that the Gravity of the Drop ſhall balance the Attraction, and then the Drop is at reſt; and in that caſe if you raiſe the End *A B* of the Plane ſtill higher, the Drop will deſcend by its Gravity, which will then overcome the Attraction.

6. Let two glaſs Planes. *A B C D*, (*Fig.* 13.) touch one another at *A B*, and at *C D* let them be a little ſeparated by the Interpoſition of ſome thin Plate, and then let their Ends be immerſed into Water tinged with ſome Colour, in ſuch Manner that the Sides *A B* and *C D* may be in a vertical Poſition, the Planes having been moiſtened with the ſame Liquor before-hand. The Water will riſe between thoſe two Plains by their Attraction, and riſe higheſt where the Planes are neareſt together; and as their Diſtance continually decreaſes from *C D* to *A B*, the Water riſes up to different Heights in every Place, and makes the Curve Line *e f g*.

7. Quickſilver unites itſelf to Tin and Gold; alſo Water and Oil ſtick to Wood and clean Glaſs.

We have Inſtances of Repulſion between Water and Oil, and generally between Water and all unctuous Bodies; between Mercury and Iron; as alſo between the Particles of any Duſt.

8. If any greaſed Body, lighter than Water, is laid upon the Surface of Water, or Piece of Iron upon Mercury, the Surface of the Fluid will be depreſſed about the Bodies laid upon it, as it appears about the Ball *A* (*Fig.* 11.). And after the ſame manner where the Attraction obtains, the Surface of the Liquor is higher about the floating Bodies, as about the Ball *B*, and does not run by a Level by its Gravity; ſo here where the repellent Force exerts its Action, Liquors, notwithſtanding their Gravity, do not run down to fill up the Cavities which are made round the floating Bodies.

Upon this depend all the *Phænomena* of very light glaſs Bubbles which ſwim upon Water; when they are clean, the Water riſes about them all round, as at *B*; but when they are made greaſy, the Water makes an Hollow all round them, as at *A*; in the glaſs Veſſel where the Experiments are made, the Water alſo ſtands higher all round next to the Glaſs, as at *C* and *D*; but when the Glaſs is ſo filled that the Water runs down from all Parts, then by the mutual Attraction of the Parts of the Water, it ſtands higher at the Middle than at the Sides, and forms the convex Surface *A B C* (*Fig.* 12.) From theſe Principles only can the following Experiments be explained.

When a Glaſs is not quite full of Water, a clean glaſs Bubble always runs to the Side, and there ſticks, provided it be not laid on too far from it. The Bubble is preſs'd every Way by the Water, when it comes to the Side of the Veſſel; the ſame Force by which the Water is raiſed there, does in Part take off that Preſſure; ſo the Preſſure on the other Side overcomes, and the Bubble is moved towards the Side of the Glaſs.

When the Glaſs is ſo full as to be ready to run over, the Bubble goes of itſelf to the Middle of the Glaſs, for the ſame Reaſon; becauſe the Force by which the Water is raiſed in the Middle, does alſo diminiſh the Preſſure upon the Bubble towards the Middle.

Juſt the Reverſe happens when the Bubble is greaſy, becauſe that Force by which the Water and the Bubble repel one another, is greateſt where the Water is higheſt.

Two clean Bubbles, or two greaſy ones, run towards each other. As to clean Bubbles, we have juſt given the Reaſon; when they are made greaſy, there is a Cavity round each of them; and when the Cavities join the Preſſure is diminiſhed, and the Bubbles run that Way.

If one Bubble be clean and the other greaſy, they fly from one another, for the Reaſons before given.

The Particles of any Salts attract one another with a very great Force, as appears by ſeveral Experiments. The following will be ſufficient to prove, that that Attraction exerts itſelf at a very ſmall Diſtance, and the repellent Force at a greater.

14. Diſſolve Salt in Water, and that Water, when reduced into Vapour, the ſmall ſaline Particles will unite together and form greater Lumps; which proves the Attraction.

Theſe Particles are all equal, and of the ſame Figure: Whence it follows, that the leaſt Parts of which they are formed had every where the ſame Situation in reſpect to each other; that is, were every where diffuſed in the Water at equal Diſtances; which cannot be, unleſs they all repel one another with equal Forces.

The Elaſticity of Bodies, namely, that Property whereby they return to their former Figure, when it has been alter'd by any Force, is eaſily deduced from what has been ſaid: For if a compact Body be dented in without the Parts falling into that Dent, the Body will return to its former Figure, from the mutual Attraction of its Parts.

We ſhall alſo in its proper Place ſhew, that that Property of the Air, which is called its Elaſticity, ariſes from the Force whereby its Parts repel one another.

And leſt any ſhould imagine, becauſe we don't give the Cauſe of the ſaid Attraction and Repulſion: We ſay here with Sir *Iſaac Newton*, 'That we conſider thoſe Principles not as occult Qualities, which are ſuppoſed to ariſe from the ſpecifick Forms of Things; but as univerſal Laws of Nature, by which the Things themſelves are formed: For the *Phænomena* of Nature ſhew that there are really ſuch Principles, though it has not been yet explained what their Cauſes are. To affirm that the ſeveral Species of Things have occult ſpecifick Qualities, by which they act with a certain Force, is juſt ſaying Nothing. But from two or three *Phænomena* from Nature to deduce general Principles of Motion, and then explain in what Manner the Properties and Actions of all Things follow from thoſe Principles, would be a great Progreſs made in Philoſophy, though the Cauſes of thoſe Principles ſhould not be yet known.

ATTRACTION. Sir *Iſaac Newton*, at the End of the *Latin* Edition of his excellent Book of *Opticks*, *Qu.* 22. ſhews, That of thoſe Bodies which are of the ſame Nature, Kind, and Virtue, by how much leſs any Body is than another, the greater is its attractive Force, in Proportion to its Magnitude. Thus 'tis found that the *magnetick Attraction* is ſtronger in a ſmall Loadſtone, in Proportion to its Weight, than in a larger: For the Particles of ſmall Magnets being nearer one to another, can more eaſily combine or join their Forces into one. Wherefore the *Rays of Light* being the leaſt of all Bodies that we know, muſt needs have the greateſt and ſtrongeſt *attractive Force*; and how very ſtrongly thoſe Particles do attract, may be collected by the following Calculation. The *Attraction* of a Ray of Light, with Regard to the Quantity of its Matter, is to the Gravity which any projected Body hath, in Proportion to the Quantity of Matter in that Body : : in a *Ratio* compounded of the Velocity of a Ray of Light, to the Velocity of that projected Body, and of the Flexure or Curvature of the Line which the Ray deſcribes in the Place of its Refraction, to the Curvature or Flexure of the Line which the ſaid projected Body deſcribes. That is, ſuppoſing the Inclination of the Ray, to the refracting Surface be the ſame with that of the Horizon. And from this Propoſition he calculates, that the Attraction of the Rays of Light is above 1000000000000000, a Thouſand Millions of Millions of Times greater than the Force of Gravity on the Earth's Surface, according to the Quantity of Matter in each; and ſuppoſing Light to come from the Sun thither in about ſeven or eight Minutes. And in the very Point of Contact of the Rays, their attracting Force may be yet much greater.

Now ſuch a prodigious Force of *Attraction* in the Rays of Light cannot but have wonderful Effects in thoſe Particles of Matter, with which they are joined in the Compoſition of Bodies; and muſt cauſe that thoſe Particles attract one another, and that they are moved variouſly among themſelves.

'Tis very probable therefore, that the *ſmall Particles of Bodies* have certain Virtues, Powers, or Forces, by which at a ſmall Diſtance they may attract only on the *Rays of Light* to *Refract*, *Reflect*, or *Inflect* them, but alſo mutually on one another, in order to produce *moſt of the Phœnomena in Nature.* 'Tis very well known that ſome Bodies do thus act one on another by the *Attractions* of *Gravity*, *Magnetiſm*, and *Electricity*: And theſe Examples ſhew what the *Reaſon and Order of Nature* is, and make it very probable, that there may be yet ſome *other Attractions*, for Nature is very uniform and agreeable to itſelf.

Now the *Attractions* of *Gravity*, *Magnetiſm*, and *Electricity*, extend themſelves to conſiderable Diſtances, and therefore are commonly obſerved and taken Notice of by every one. But 'tis very poſſible that there may be many *others* alſo, which are contained in ſuch narrow Limits, and performed within ſuch a little Diſtance, as yet to have eſcaped all our Obſervations.

For when *Salt of Tartar* runs *per deliquium*, or diſſolves into an Oil, as the *Chymiſts* call it, 'tis very probable that it is occaſioned by ſome *Attraction* which is mutual between the Particles of the Salt and thoſe of Water, which rove up and down in the Air in the Form of Vapour; and the Reaſon why *common Salt*, *Nitre*, and *Vitriol*, don't run thus *per deliquium*, is becauſe they are without any ſuch *Attractions*; and when *Salt of Tartar hath* drawn as much Water out of the Air as its Quantity will bear, it draws no more, becauſe when it is ſaturated, the Attraction is at an End. It muſt be alſo from its attractive Force, that the Water thus imbibed by the Salt, *cannot be ſeparated from it in Diſtillation but by a very violent Heat*; whereas, Water will uſually diſtill off with a very eaſy Heat, from other things. 'Tis much the ſame thing with *Oil of Vitriol*, which till it is ſaturated with it, attracts the Moiſture of the Air in very conſiderable Quantity, and afterwards parts with it with great Difficulty. And when Oil of Vitriol and Water, being mingled together in the ſame Veſſel, grow ſo hot, as it is known they will do, it appears plainly by that Heat, that a very great Motion is excited in the Particles of the two Liquors; and from that Motion it appears that their Particles in mingling coaleſce with a great Force and Impetuoſity, and conſequently attract or gravitate towards one another with an accelerated Motion. Thus alſo when *Aqua Fortis*, Spirit of *Vitriol* or *Nitre*, or any other corroſive *Menſtruum*, diſſolves Filings of Iron or any other Metal with Heat and Ebullition, 'tis plain that the acid Particles of the *Menſtruum* attract and ruſh upon thoſe of the Metal with a very great Force, enter into their Pores with Violence, and disjoin or ſeparate the ſmall Corpuſcles of which the Metal is compoſed, one from another; tho' the Particles of the acid *Menſtruum* are drawn off at firſt when they are made by a moderate Heat, yet after their Union, they, with the Parts of the Metal, cannot be drawn off as yet by *Diſtillation*, but by a moſt intenſe and violent Heat.

When *Spirit of Vitriol* poured upon *common Salt* or *Nitre*, makes an Ebullition, and coaleſces with the Salt; and when after this, if the Compoſt be diſtilled, a *Spirit* of *Salt* or *Nitre* will be drawn off much eaſier than without ſuch a Mixture; it ſhews plainly, that the *Fixt Alkali* of the Salt attracts the acid Spirit of the *Vitriol* much more ſtrongly than it doth its own Spirit, and becauſe it cannot detain them both, it parts with its own Spirit freely. When Oil of *Vitriol* is diſtilled from an equal Weight of *Nitre*, and from both is drawn off a *compound Spirit of Nitre*, and that Spirit is poured upon half its Weight of Oil of *Cloves*, of *Caraway-Seed*, or any ponderous Oil diſtill'd from vegetable or animal Bodies, or upon Oil of *Turpentine*, mixed with a little Balſam of *Sulphur* to thicken it; when in any of theſe Mixtures an actual Flame will be produc'd, 'tis apparent that the Particles of the Spirit and Oil muſt ruſh towards one another with a ſtrong accelerated Motion, and ſtruggle and fight with a moſt violent Force and *Impetus*. 'Tis the ſame thing when that compound Spirit is poured upon well-rectified *Spirit of Wine*, for a Flame will immediately ariſe on their Mixture. The *Pulvis fulminans*, as they call it, which is compoſed of *Sulphur*, *Nitre*, and *Salt of Tartar*, goes off with a more quick and violent Exploſion than even *Gunpowder* itſelf. The acid Spirits of the *Sulphur* and the *Nitre* ruſhing together with ſuch Violence, that all the Parts of the Powder are rarified, as it were, at once and all together.

Thus alſo common crude and impure *Brimſtone* itſelf, if it be powder'd and mingled with an equal Weight of Filings of *Iron* or *Steel*, and with a little Water be made up into a thick Paſte, like Dough, the *Sulphur* will act ſo upon the *Iron*, that in five or ſix Hours Time the Maſs will grow ſo hot as not to bear Handling, and at laſt will plainly burn and emit a Flame. Now from all theſe Experiments, and from the Conſideration of the great Quantity of *Sulphur* that there is in the Earth, and of the great Heat of the inner Parts of it, from the hot Springs, the burning *Vulcanos*, the *Fire Damps* and burning *Exhalations* that are found in the Bowels of the Earth; from the Conſiderations of *Earthquakes*, *Whirlwinds*, and the wonderful *Convulſions* that the Sea is ſometimes put into; we may underſtand, That the Particles of Bodies, before at Reſt (and 'tis the ſame thing alſo in all Fermentations, *&c.*) may be and are put into moſt violent Motions, by ſome Principle of very great Force and Activity, which yet doth not diſcover it ſelf till the Parts *approach* and *come very near* one another; but that they do then attract one another with great Force and Rapidity, and thereby produce their wonderful Effects.

Again, When Oil of *Tartar per deliquium* is poured upon the Solution of any Metal, there is a *Precipitation* of the *Metalline Particles* produc'd, which all fall down to the Bottom of the Veſſel; from whence it appears, that the Particles of the Liquor are more ſtrongly attracted by thoſe of the Oil of *Tartar* than by thoſe of the Metal, and by that *Attraction* are precipitated down from the Liquor: So alſo when a Solution of *Iron* in *Aqua Fortis* will diſſolve *Cadmia*, and precipitate its Iron; or when a Solution of *Copper* will diſſolve *Iron*, and let go the *Copper* (*ſee depart*) *&c.* this ſeems to prove plainly, that the acid Particles are more ſtrongly *attracted* by thoſe of the Metal that they diſſolve, than by thoſe of that which is let go. When we find that thoſe *Menſtruums* which will diſſolve one Kind or Metal or mix'd Body, won't touch another, it muſt be attributed to the *Attraction* that there is between the Particles in ſome Caſes, and there being no ſuch in the other. And in the general it is owing to this Principle, that *Heat*, according to *Ariſtotle*'s Definition of it, *doth congregate or gather together homogeneous Things, and ſeparate thoſe which are of a different Nature*: After this he ſhews how on this Principle, and by the

Help of *Chymical Analyſes*, to come to the Knowledge of what Kind of Parts natural Bodies are compoſed,

The Reaſon why Drops of Water, or other liquid Body uſually put on a ſpherical Form, he ſaith, is alſo from the *mutual Attraction* of their Parts ; after the ſame Manner as the Earth and Seas make one round Body by the *mutual Attraction* or *Gravitation* of their Parts.

And becauſe when Metals are diſſolved in Acids, they attract but a ſmall Portion of the *Menſtruum* to them, therefore he concludes, that their Force of *Attraction* extends but a *very little Way*. And as in *Algebra*, when affirmative Quantities vaniſh and terminate, their negative begin : So in *Mechanicks*, where *Attraction* ceaſes to exert it ſelf, a Kind of *repelling Force* ſhould ſucceed ; and that there is in Nature ſuch a Force, ſeems to follow from the *Reflexion* and *Inflexion* of the Rays of Light ; for in both theſe Caſes, the Rays are repelled from Bodies without the immediate Contact of the *reflecting* or *inflecting Body*. And the ſame thing ſeems concludable from the Emiſſion of Light ; for a Ray of it, as ſoon as it is ſhaken out of the lucent Body by the vibrating Motion of its Parts, and is got without the Sphere of its *Attraction*, is propelled with a very great Degree of Velocity ; and the ſame Force which in Reflection ſerves to *repel* the Ray, now ſerves to emit it.

The *Production of Air* and *Vapours* doth alſo ſhew that there is a *repelling Force* ; for thoſe Particles which are forced out of the Bodies by Heat or Fermentation, as ſoon as ever they are out of the Sphere of the *Attraction* of theſe Bodies, do immediately recede from it, and from another with a great Force, and do avoid coming together again ; ſo that ſometimes they take up above a Million of Times the Space which they did before, when they were in the Form of a *denſe* Body, which is ſo very great a *Contraction* and *Expanſion* as is hardly conceivable, if the Particles of the Air be only *elaſtical*, *ramoſe*, and *coiled* up one within another, like the Tendrels of *Vines*, or Springs of Watches, as ſome have imagined : Nor indeed, will any other Hypotheſis account for this wonderful *Phœnomenon*, but this of their being endued with a repelling Force, by which they mutually avoid one another, as well as the Bodies from whence they at firſt came.

ATTRACTION. This is a Property or Matter by which are accounted for all the grand Appearances in the inanimate World, and which the great Sir *Iſaac Newton* firſt taught us to reaſon about with Certainty. The Subſtance of what has been digeſted into Order to ſupport many *Phyſical Reaſonings*, may be apprehended by the following Propoſitions.

Prop. 1. The Quantity, or Force of *Attraction* in all Bodies, is exactly proportional to the Quantity of Matter in the attracting Body, as being in Reality nothing but the Reſult or Sum of the united Forces of all thoſe ſingle Particles of which it is compoſed ; or in other Words, *Attraction* in all Bodies, is, *cæteris paribus*, as their *Solidities* : Hence,

Corol. 1. At equal Diſtances, the *Attractions* of homogeneal Spheres will be as their Magnitudes : And,

Corol. 2. At any Diſtance whatever, the *Attraction* is as the Sphere divided by the Square of the Diſtance.

Prop. 2. The Attractive Force is infinitely greater at the Contact, or extreamly near it, than at any determinate Diſtance.

The Attractive Force exerts itſelf only where the Tendency of a Particle another Way is over-power'd by its Proximity to that into whoſe Contact it is ſuppoſed to be drawn : For as this Property is univerſal, and every Part of Matter does draw, and is drawn by every other Part of Matter, within one another's Spheres of Attraction ; ſo one cannot influence another at any Diſtance, but muſt neceſſarily be very near it ; and ſo much the nearer, in Proportion to its Smallneſs ; ſo that upon a double Account, two Particles cannot influence one another by their Attractions unleſs very near : One from their predominant Inclinations another Way, and the other from the Minuteneſs of their Spheres of Activity ; inſomuch that out of that Reach, could they be ſuppoſed under no other Tendency, they would never come together.

Prop. 3. A large Particle attracts not more ſtrongly than a ſmall one of the ſame Solidity ; but Diverſity of Figure cauſes different Degrees of Attraction in Particles that are otherwiſe the ſame.

This is almoſt a Conſequence from the former Propoſition ; for as this attractive Force can only act on ſuch Particles as are extreamly near, the remoteſt Parts in a large Particle can conduce nothing thereunto. And for the ſame Reaſon this Power varies, according as Matter is in Cones, Cylinders, Cubes, or Spheres ; and a ſpherical Particle, *cæteris paribus*, has the ſtrongeſt Attraction, as there is more Solidity under ſuch a Surface, than in any other Figure.

Prop. 4. If Particles ſwimming in a Fluid attract one another more ſtrongly than they do the Particles of the Fluid, the Force by which they come to each other, will be as the Exceſs of their mutual Attractions to their Attractions of the Fluid, ſuch Parts of the Fluid as interpoſe between the attracting Particles will be thruſt or preſs'd upon by ſuch their Inclinations to each other ; and therefore according to the Nature of Fluidity, the Parts of the Fluid will be drove out of their Places by ſuch Exceſs of Preſſure, and thereby the attracting Particles will join.

Prop. 5. If Particles ſwimming in a Fluid are more attracted by the Fluid than by one another, they will recede from one another with a Force that will be equal to the Difference of their mutual Attractions, and the Attraction of the Fluid.

For the ambient Particles of the Fluid attracting them more ſtrongly then they do each other, they will by ſuch Exceſs of Force be drawn from one another into Contact and Coheſion with the Particles of the Fluid. Upon the two foregoing depend the whole Theory of Chryſtallization and Solution.

Prop. 6. The Force by which Particles attracting on one another cohere, is, *cæteris paribus*, in Proportion to their Contacts.

For thoſe Parts not in Contact, conduce nothing, or extreamly little, to the Force of Coheſion ; and a much greater Power is required to ſeparate two Particles which cohere in two Points, than two Particles which cohere only in one Point : For which Reaſon it is, that we find two poliſhed Marbles to adhere more ſtrongly than any other two Bodies of equal Dimenſions which are not ſo ſolid, but have more Pores and Interſtices between their Parts, and which will not receive ſo good a Poliſh, by which their Parts are brought into ſo cloſe a Contact with one another. And for the ſame Reaſon it is, that many light Subſtances have ſuch ſtrong Coheſions and Tenacities; for that whereby Particles of the leaſt Matter in Proportion to their Surfaces, are ſpecifically lighteſt, alſo occaſions their ſtrongeſt Coheſions, by being capable of more Contact than Particles of more Solidity under leſs Surface.

Prop. 7. If the attracting Particles are elaſtick, they muſt neceſſarily produce an inteſtine Motion, greater or leſſer, according to the Degrees of their Elaſticity and attractive Forces.

Becauſe upon the Occurſions which their attractive Powers draw them into, they will fly off from one another again with the ſame Degree of Velocity that they meet together with, abating the Reſiſtance of the Medium; but when they approach other Particles in their Reſilition, their Velocity muſt increaſe, becauſe they are afreſh attracted; and therefore meeting a ſecond time, they will recede with a greater Velocity than they did at their firſt Concurſion; which will continue an inteſtine Motion, as are their attractive Powers and Elaſticities.

Prop. 8. Particles attracting one another in a Fluid, moving either with a ſwift or a ſlow progreſſive Motion, attract one another juſt the ſame as if the Fluid was at reſt, if all the Particles move equally; but an unequal Velocity of the Particles will interrupt their Attractions.

All the Parts of the Fluid moving on with equal Velocity, leaves the attracting Particles in the ſame Condition as if the Fluid was at Reſt; but ſome Parts moving faſter than others, muſt frequently change their Poſitions, and thereby diſturb their Attractions. Thus it is that Salts will not chryſtallize, till the Water in which they are diſſolved is near or quite cold, and the inteſtine Motion of its Particles, cauſed by Heat, is quieted.

ATTRACTION. 1. The Loadſtone, by an inviſible Force which differs from that of *Gravitation*, and alſo of *Electricity*, draws unto itſelf Loadſtone, Iron, and Steel; and with the ſame Kind of Force or Power, does not (at leaſt very ſenſibly) attract any other Body whatſoever.

2. The Loadſtone attracts Loadſtone, Iron and Steel, with a polar Attraction; and whatſoever Attraction is not polar, is not magnetical.

3. The two oppoſite Parts of a Loadſtone attract moſt vigorouſly, and are called the Poles thereof; the Middle between the two Poles doth not attract at all, and may be called its Equinoctial; and from each Pole to the Middle the attracting Force does gradually abate.

4. In every Loadſtone, the one of its Poles is in Vertue (or rather in Direction) contrary to the other, and therefore they need to be diſtinguiſhed from each other, which is done by adding *North* or *South*. The *North* Pole of one Loadſtone will not attract, but repel the *North* Pole of another, though they are poſſeſſed of ſimilar directive Vertue; neither will the *South* Poles of any two Loadſtones attract, but mutually repel one another: But the *North* Pole of one Loadſtone, and the *South* Pole of any other, do mutually attract each other; and though their directive Vertue is contrary, yet the unknown Cauſe of their Attraction and Repulſion ſeems to be the ſame.

5. There is no Difference between the Force of Attraction and that of Repulſion in the ſame Pole of any Loadſtone, unleſs when a ſmall one approaches ſo near to a large one, as to have its Polarity more or leſs diminiſhed thereby.

6. No interpoſed Body whatſoever (unleſs it is magnetical) though the moſt ſolid in Nature, can impede or divert any of the Effects of a Magnet; for it is always found to attract magnetical Bodies full as powerfully at the ſame Diſtance, as if nothing at all was between.

7. Every *Fruſtrum* of a Loadſtone is an entire or perfect Loadſtone, having in itſelf both Poles, as the whole Stone had; and the Poles in each *Fruſtrum* have their Directions (as near as the Figure of it will admit) in the parallel Line wherein they were directed both in it and the whole Stone, before it was ſeparated therefrom.

8. All magnetical Attraction, as alſo Repulſion, is mutual; for Iron or Steel attract the Loadſtone, as that does Iron or Steel, and they alſo attract one another.

9. Every Loadſtone communicates Vertue to Iron or Steel, not only by Contact, but even by an Approach of them within its attractive Sphere, more or leſs as nearer to, or farther from its Body, and likewiſe its Poles, alſo according to the Shape, Bulk, and ſpecifick Vertue thereof, and Figure of the Iron or Steel, and their Proportion of Magnitude to one another. And though a great Magnet (that is to ſay, ſuch as are ſimilar in Figure and ſpecifick Vertue) will lift conſiderably larger Irons than a ſmall one, yet the ſmall one ſhall give to the ſame Piece of Steel (provided it be not too large for it to conquer) nearly as ſtrong a Touch as the great one; and if the ſmall one is ſpecifically better, it will give the ſame ſmall Piece of Steel a conſiderably ſtronger Touch than the great one can; though the great one is capable of lifting perhaps three or four times ſo much as the ſmall one.

> *Note*, That if the great one is ſo ſtrong as to give the ſmall piece of Steel ſo much Vertue as it is capable of receiving (for there is, I ſuppoſe, a *ne plus ultra*) that then ſhould the ſmall Stone be ever ſo much better, it cannot mend the Touch given by the great one.

10. Steel is not only more receptive, but more retentive of Magnetiſm than common Iron; Iron or Steel hammer'd hard, than the ſame while ſoft; but Steel hardened by quenching, than either of them; Steel cannot be too hard for Retenſion (nor, as I think, for Reception) of Magnetiſm.

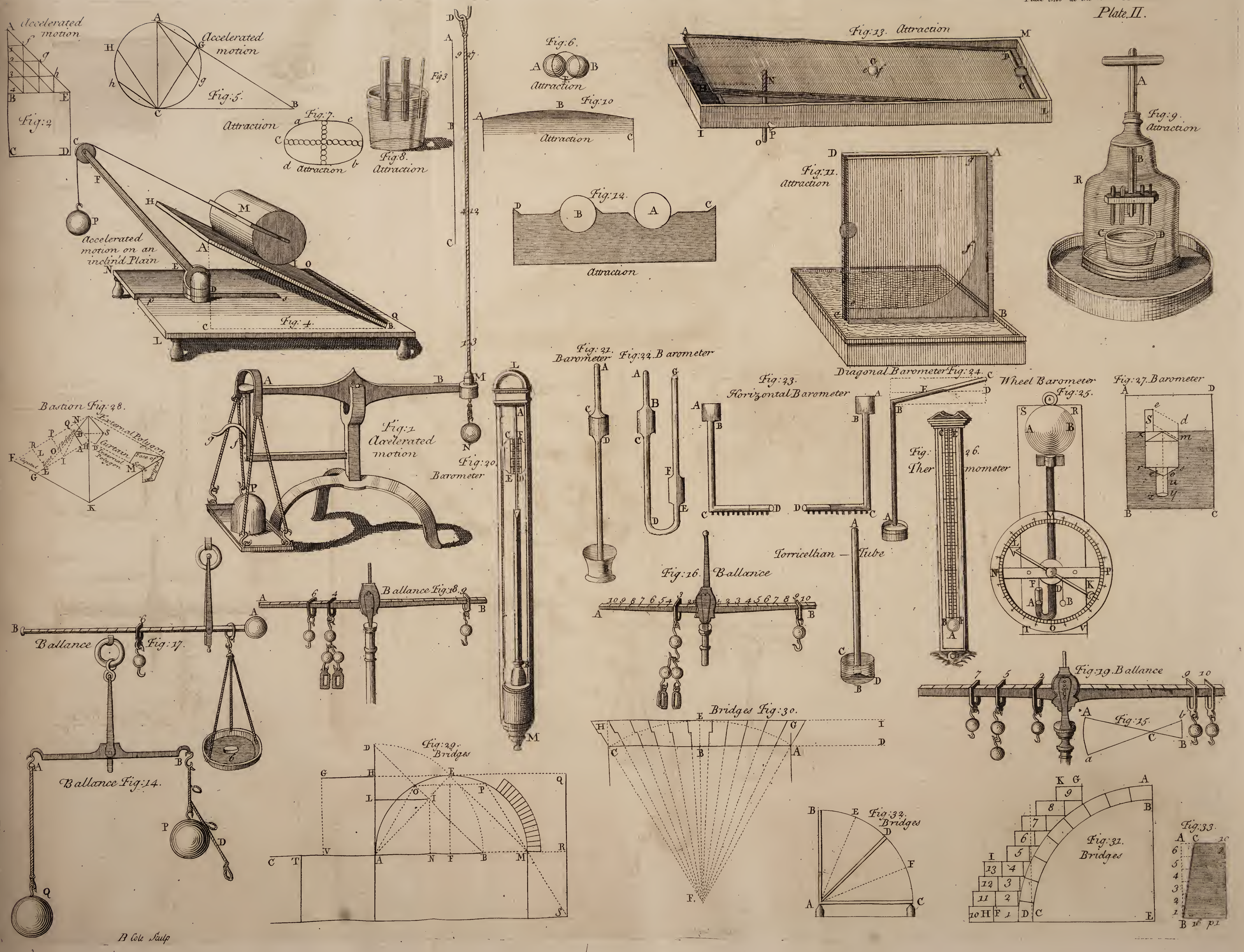
11. It has been obſerved, that oblong pieces of Iron or Steel applied any how to the Loadſtone, receive Vertue chiefly as to their Lengths.

12. Such Iron and Steel as has magnetick Vertue communicated to it, does alſo communicate thereof to other Iron or Steel after the ſame Manner as a Loadſtone does; which Vertue, after never ſo many Communications, is, as to its Nature, perfectly the ſame with that of the Stone itſelf, having both Poles, and will touch other Steel; and that other Steel will touch a Compaſs as well and as ſtrong as the Loadſtone itſelf, if rightly uſed.

13. It is ſuppoſed that the Earth contains within it, at or near its Centre, a Loadſtone or Magnet (probably ſpherical) large enough very ſenſibly to affect magnetical Bodies all over the Surface of the Earth. The Poles of its Attraction are conſiderably diſtant from thoſe of its own, which are the ſame with thoſe of the Earth's diurnal Rotation. This internal Magnet muſt either be looſe from the Body of the Earth, and revolve within it very little ſlower, or elſe, if it is fixed to the Earth, the very

Place this at the word Attraction

Plate. II.



B Cole Sculp

Polarity itſelf muſt have changed its Situation in reſpect of the ſaid Magnet; one of which, ſeveral recorded Obſervations in diſtant Years ſufficiently prove; the former ſeems to be moſt probable.

14. Every Loadſtone within its attractive Sphere has a Power (the nearer either of its Poles the greater) to keep one Piece of Iron ſuſpended to another, eſpecially if that to which it is ſuſpended is the largeſt, and their Ends be bright and clean where they touch one another; and if the ſuſpended Iron is not too heavy, the other will draw it up from either Pole of the naked Loadſtone actually touching it, and will alſo keep it ſuſpended till at a conſiderable Diſtance therefrom; but will not draw it off in ſuch Manner from the Armour of an armed Stone, if the Armour and Iron are both of them bright and clean at the Place of their Contact. Hence it muſt follow,

15. That an armed Loadſtone can lift more with either of its Poles, uſed ſingly than the ſame can lift naked; and this it will do, though the Armour ſhould be narrow, and touch very little of the Stone, how much more then will it lift, when the plated Part thereof covers all the End of the Stone, and ſecures all the Vertue of that Pole to which it is applied, leading it to the other End which attracts?

Soft Iron is thought to be as good for Armour, if not better, than the hardeſt Steel.

16. Not only Steel or Iron regularly touched, but alſo oblong Iron void of permanent Virtue (ſo long as it has a tranſient Vertue by Poſition of either of its ends towards the Pole of a Loadſtone large enough to affect it at a conſiderable Diſtance) will perform all that any Loadſtone can, though not with the ſame Degree of Power: For either of them will attract, keep one piece of Iron ſuſpended to another, and communicate ſome Degree of permanent Polarity to Steel well hardened, or to an Iron Wire, as has been proved by Experiments.

17. The Earth's central Loadſtone or Magnet has all the ſame Vertues which others have, and no diſcover'd ones beſides; and though we cannot approach it, yet it adds as others do at a proportionable Diſtance.

18. That of a ſoft Iron Bar void of fixed Polarity, ſo ſoon as it is an erect Poſition, the higher Part from the Middle and upward becomes a North Pole in North, or a South Pole in South magnetick Latitude; and, *e contra*, the lower Part from the Middle downward becomes a South Pole in North, and a North Pole in South Latitude: But ſo ſoon as ever the Bar is inverted, the Polarity will be ſhifted in it, and in North Latitude the End newly placed upward becomes the North Pole, though it was a South one immediately before, and the other End the South Pole, though it was its North one juſt before. The Caſe is the ſame, if ſuch a Bar is placed horizontally in or near the magnetical Meridian; for the End directed toward the North will conſtantly be a South Pole, and that which is directed toward the South, a North one, and ſo ſoon as ever the End of the Bar is ſhifted, the Polarity, in reſpect of the Bar, is ſhifted alſo (but not in reſpect of the Earth) for which Reaſon this Vertue is called *tranſient*, and is communicated by the Earth's Magnet in ſuch Manner as other Loadſtones are ſaid to do. *Page* 309, *Pro.* 16th.

19. Since in the North Latitude the North Pole of the Earth's central Magnet not only gives the Vertue of a South Pole to that End of a Bar which is neareſt to it, but alſo helps it to lift Iron, when neither the Bar nor Iron lifted has any permanent Vertue; the ſaid Magnet muſt therefore neceſſarily help the South Pole of any Loadſtone or touched Steel in lifting Iron, but hinders its North Pole; this agrees with common Experience; the North Pole of a Magnet being unable to lift ſo much as its South one in North Latitude, but more in South Latitude.

20. The preceeding plainly ſhews, why an armed Magnet, when both its Poles are applied to a Piece of Iron, will lift ſeveral times ſo much as with either Pole ſingle; for the North Pole of the Magnet, by ſending its Vertue through the attracted Iron, powerfully helps the South Pole of the ſaid Magnet in attracting. Again, the ſtrengthened South Pole muſt more powerfully increaſe the Attraction of the North Pole; and ſince the Poles mutually aſſiſt one another's Attraction, with a Power much greater than if they themſelves are not aſſiſted, the conjunct Poles muſt neceſſarily lift at leaſt twice ſo much as both of them can lift ſeparately. I once tried, and found the South Pole armed to lift 1125 Grains, and both Poles united 5760 with a little more Difficulty. The Ratio is about 1 to a little more than 5.

21. That if a Bar of Iron or Steel (not having the leaſt Degree of fixed Vertue) is placed in any Poſture (except at, or near to a Right Angle with the magnetical Line) it will not only for the preſent receive a tranſient Polarity thereby, but if it ſo remains long enough, the ſaid Polarity will gradually become fixed or permanent more or leſs, according to the Hardneſs or Softneſs of the Bar, Time it has remained in that Poſition, Angle its Length makes with the magnetical Line, and Proportion of the Length thereof to its Bigneſs, the longeſt (*cæteris paribus*) uſually receiving moſt Vertue; and ſometimes when all theſe Advantages concur, the Polarity will be ſenſibly permanent in a little Time, and not require a very long Time to be rendered pretty ſtrong.

22. That by placing the ſaid Bar afterwards in the ſame Poſition, only with its Ends ſhifted, it will gradually loſe its gained Magnetiſm, and at Length have its Polarity changed.

23. That Magnetiſm not only in touched Iron and Steel, but alſo in the Loadſtone itſelf, is ſoon deſtroyed by Fire.

24. That though Fire deſtroys fixed Magnetiſm in Steel or Iron, yet if they are ſet to cool in an erect Poſture, or rather in the Direction of the magnetical Line, they will gain more or leſs fixed Vertue by the time they are cold; but eſpecially Steel heated to a ſeaſoning Height, and in that Poſition cooled ſuddenly under Water, which I have found to fix its Polarity ſo thoroughly, as that with its North Pole held downward, it would attract the North End of a Duck Needle.

25. That while a Piece of Iron of ſome Magnitude is held at one Pole of a Loadſtone, it will increaſe the Attraction of the other Pole thereof, and enable it to lift ſomewhat more.

26. That if either Pole of a Magnet large enough, toucheth one End of an oblong piece of Steel (not too big and long for the Magnet eaſily to act on) it will tranſmit its own Vertue to the other End of the Steel which is fartheſt off, and make it a Pole of its own kind, while the End which touches the Stone has the Vertue of the contrary Pole; but the Vertue uſually is not ſo ſtrong in the End which is untouch'd, as in that which is; though I do not know but in ſome Time it may gain more, and the

other loſe ſome, until the Vertue in each End is nearly equal.

That any Loadſtone put in a Diſh with its Polarity in an horizontal Situation, and the ſaid Diſh, with the Stone in it, put to ſwim in the Middle of a large Veſſel of Water, will turn itſelf with the Diſh wherein it is, until its South Pole is directed in the Horizon towards the magnetical North Pole of the central Magnet (by the Force of its Attraction therefore, and Repulſion of the oppoſite Pole) and there reſt after a ſmall Vibration or two.

27. That the Fly of a Compaſs (becauſe it is a perfect Magnet, *Prop.* 12.) if it turns eaſy on its Pin, muſt neceſſarily conform its Poles to the magnetical Meridian, as the Loadſtone does, and for the ſame Reaſon.

28. Alſo becauſe Steel regularly touched is a perfect Magnet, the North Ends of the Flies of ſeveral Compaſſes muſt all of them repel one another, and ſo muſt their South Ends; but the North End of one, and the South End of any other, do mutually attract each other, as is ſaid of Loadſtones, *Pro.* 4. and in North Latitude the North End of a Needle will conſequently vibrate towards the Top of a tranſient Bar erected, and the South End towards the Bottom.

29. That a Needle, firſt equally poiſed, then touched and put to oſcillate on its Pivots in the magnetical Meridian, will in North Latitude have its North End (*i. e.* its South Pole) depreſs'd until it directs to the North attracting Point of the central Magnet; where, after ſeveral Oſcillations, it will at laſt reſt; and in South Latitude the South End will be depreſs'd after the ſame Manner.

30. That not only a touched horizontal Needle, which has permanent Polarity, will endeavour to conform itſelf to the magnetical Meridian, but alſo one that has no other than tranſient Vertue, and is with the greateſt Care freed from fixed Magnetiſm (if made and uſed as in the *præcogn.*) will do ſo too, though with this Difference, that which End ſoever happens to be placed neareſt the magnetical North will faintly turn thither, and if that End is not ſuffered to remain ſo too long, then the other End, placed neareſt to the North, will turn thither as the firſt did. In trying this Experiment, I ſometimes found, that when the Needle had reſted in the Meridian only a few Minutes, it gained a perceptible permanent Vertue, ſo that its other End would not be attracted to the magnetical North, unleſs it was placed conſiderably nearer thereto than I had placed the firſt End; and having ſo ſtood ſome time, loſt again the ſaid inchoate Permanency, and received Polarity, the contrary Way, once, while I dined, and ſat but a little Time after, I could not make the End towards the South to ſtand towards the North, unleſs I placed it very true in the Meridian, ſo that I was forced to free it again from Magnetiſm before I could make it repeat the ſame, or try the following Experiment; for the leaſt Fixedneſs of Polarity in the Needle would more or leſs obſtruct both.

At the magnetical Eaſt or Weſt of the Needle's Pin, ſo nice as I could gueſs it, I held at a great Diſtance, either the South Pole of a Loadſtone, or lower End (which is the South Pole) of an erected Bar (both of them anſwered alike) and gradually approached it nearer, in a direct Line, towards the Pin, until it began to attract the Needle, which I obſerved was as I expected at the South End: I then chang'd the Ends of the Needle, and gradually approached the South Pole of a Magnet, as before, and conſtantly found it to attract that End which was towards the South; and the North Pole of the Magnet, after the ſame Manner, would attract the North End of the Needle, when it had only tranſient Vertue.

ATTRACTIVE, the ſame with *Attracting.*

ATTRAHENTS, [in *Phyſick,*] attracting or drawing Medicines, ſuch as by their minute Particles open the Pores of the Body ſo as to diſperſe the Humours, cauſe the Parts to ſwell, and draw Bliſters in the Skin.

ATTRIBUTES, [in *Painting* and *Sculpture,*] are *Symbols* added to ſeveral Figures to intimate their particular Office and Character, as an *Eagle* to *Jupiter*, a *Peacock* to *Juno*, a *Caduce* to *Mercury*, a *Club* to *Hercules*, and a *Palm* to *Victory*.

ATTRIBUTIVE *Juſtice*: See *Juſtice.*

ATTRITION, [in *Theology,*] is a Sorrow for offending God, ariſing from the Apprehenſion of being obnoxious to Puniſhment and Miſery on the Account of ſuch Offence.

ATTRITION. *Concerning the Attrition of* Amber on *Woollen in Vacuo.*

Experiment I.

I took ſome Amber Beads, of the Bigneſs of ſmall Nutmegs, and having paſs'd through them, apply'd them by that Means to a circular Piece of Wood, which was turn'd with a Groove on the Edge of it, on Purpoſe to keep the Beads from being diſplaced by the ſmart Friction they were to endure. Likewiſe, for their better Security and Faſtneſs, there were ſo many *Pins* or Pieces of ſmall Wire driven through the Wood; and between every Bead there was a String tied over from Pin to Pin; the Beads at the ſame time ſtanding out by the Space of their Semi-diameters beyond the Body of the Wood into which they were fixed.

In this Manner was the whole put upon the Spindle, and made faſt there by the Nuts, (as was expreſſed before in the Deſcription of the Machine:) Then the braſs Plate on which the Woollen was wrapt, being ſcrew'd to its Place, (by Means of the Socket, which receives the lower Point of the Spindle,) would ſpring back, and graſp the Amber with a moderate Force. Theſe things thus prepared, the Receiver was thus placed over them altogether, with its upper Plate and Box for the Spindle to paſs through: The Pump being ſet to Work, the Mercury in the Gage was in a very little Time elevated to about 29 ½ Inches, which ſhew'd the Receiver to be well exhauſted. And now the great Wheel of the Machine being turn'd, the Amber had a very ſmart Attrition on the Woollen. At firſt, nothing remarkable appear'd; but in the Space of a Second or two of Time, there was a Light which became ſenſible enough: For where-ever the Attrition of the Amber was made, while the Motion went on, there and at all Times did the Light continue without Intermiſſion, and might be diſcern'd at three or four Foot Diſtance. Indeed it wou'd not continue if the Amber did any Way deſert the Woollen, notwithſtanding the exceeding Velocity of the Motion. But where the Attrition was uninterrupted, the Appearance of the Light was ſo too, and propagated itſelf to that Diſtance I have mentioned: And how ſwift the Motion was which was given in order to the Production of this Phænomenon, may be eſtimated from the Diameters of the ſeveral revolving Parts; for the Diameter of the great Wheel was 23 Inches; that of the ſmall one mov'd by it, was 1½ ; that of the Wood and Amber on the ſame Spindle with the ſmall Wheel, was 4½. Now, ſuppoſing the great Wheel to make two Revolutions in a Second, I think it follows, that the Velocity of the extreme Parts of the Amber muſt be at the Rate of a Mile in three Minutes. As this violent Motion (as it may well be expected) was attended with Heat alſo, and ſuch as diſcover'd itſelf by plain and ſenſible Marks; for the Amber (beſides what the Touch diſcover'd) appear'd manifeſtly to be burnt and crack'd ; and the Woollen was not only diſcoloured, but perfectly ſcorch'd by the intenſe Heat.

I will conclude the Account of this Experiment with this one Remark, relating to the Light produced by this Attrition, *viz.* That though the ſame Motion and Friction was given the Amber in the *open Air* as in the *Vacuo*, yet in the former Caſe the Light was *very ſmall and faint*, in Compariſon of what it was in the latter.

By this Experiment therefore we learn,

1. *That Light is produceable* in Vacuo, *by the* Friction *of a* ſolid Body (*as* Amber) *againſt a Body of a* ſoft *and* yielding *Nature*, (*ſuch as* Woollen.)
2. *That this is not a meer* lambent *Fire, but ſuch as is accompanied with a great Heat.*
3. *That this Light depends ſo immediately on the* Attrition, *as to diſappear when that ceaſes.*
4. *That it requires a very thin and rare Medium, in order to its Appearance; and the thinner the Medium, the greater the Appearance.*

Experiment II.

Concerning the Attrition of Flint and Steel in Vacuo.

Having provided a Steel Ring about 4 Inches Diameter, and 1 8th of an Inch thick, I fixed it between Pieces of Wood (of a leſs Diameter) on the *Spindle* with the *Nuts*, as in the foregoing Experiment ; the Edge of the Ring ſtanding out beyond the Extremity of the Wood which held it, about half an Inch. The braſs Plate (which I made uſe of for faſtening the *Woollen* for the Attrition of the Amber) ſerv'd here alſo to fix a Piece of Flint, an Edge or Corner of which was placed towards the Steel : And this braſs Plate, by Virtue of its Spring, would hold the Flint pretty ſtrongly to the Steel, notwithſtanding ſome Parts of it might be worn or chipp'd off by the Rapidity of the Motion. And in this Manner 'twas covered with a Receiver, a braſs Plate, and Box (as the former was.)

Before any Air at all was exhauſted, the great Wheel was turned, which gave a Motion to the ſmall one, and conſequently to the Steel ; and by its Colliſion with the Flint, there were Sparks of Fire produced in great Plenty : But after ſome Air had been withdrawn, and the Motion given, as before, the Sparks which then appeared were neither ſo numerous as before, nor ſo bright and lively. And as more and more Air was ſtill drawn out of the Receiver, ſo this Change in the Sparks produc'd became more and more manifeſt. At every Stop made, to repeat the Experiment in an higher Degree of Rarefaction, I found the Sparks ſtill to diminiſh, both in their *Luſtre* and their *Quantity*, till at laſt, when the Receiver came to be well exhauſted of Air, there was not one Spark to be ſeen, though a much greater Motion was given than before, and conſequently a more ſtrong and valid Colliſion of the Flint and Steel. All the Appearance in this Caſe was, only a faint, continued, little Streak of Light, viſible on the Edge of the Flint that was rubb'd by the Steel.

This being try'd, there was then ſome Air let into the Receiver, upon which (the Motion being given as before) ſome Sparks were diſcovered; but of a *dull gloomy Hue:* Upon the letting in a little more Air, by I know not what Accident, the whole Quantity of Air forc'd itſelf in, and then the Wheel being ſet to work again, *the Sparks appeared as numerous and vivid as at firſt.*

The Concluſion therefore from this Experiment is, *That the Air's Preſence is abſolutely neceſſary to that vigorous expanſive Motion of the Parts of Bodies; wherein the Nature of Culinary Fire conſiſts.*

Qu. Whether the Light viſible on the Edge of the Flint, when the Receiver was well exhauſted, was not of the ſame (*lambent*) kind with other Lights produc'd by the Friction of certain Bodies, of which Mention is made in ſome of our Experiments?

Experiment III.

Concerning the Attrition of Glaſs and various other Bodies in Vacuo.

1. *Concerning the Attrition of Glaſs and Woollen.*

I took a *glaſs Globe* of about four Inches Diameter, having a Paſſage through the Middle of it to receive the *Spindle*, which was faſtened to it with Corks and Screws. The Woollen, againſt which the Friction was to be made, was the coarſeſt Sort of that which is commonly uſed for *Gartering*, which I choſe purpoſely on the Account of its Harſhneſs, as being likely to improve the Phænomenon to a higher Degree than the Cloth Liſt I had uſed before. This was wrapped about the Arms of the braſs Spring; and being ſcrewed down to its Place, gently embraced the Globe. Then a larger Receiver was put over all, and the Pump being ſet to Work, in a little Time the Air was exhauſted out of the Receiver. The great Wheel being then turn'd, gave fifteen Revolutions to the included Globe, at each of its own ; which ſwift Motion giving a ſmart Attrition on the Woollen, quickly produced a beautiful Phænomenon, *viz.* a *a fine purple* Light, and *vivid* to that Degree, that all the included *Apparatus* was eaſily and diſtinctly diſcernable by the Help of it. And thus it continued while the Friction laſted.

Upon the *letting* in a little Air, the *Light* and the *Colour* were both chang'd ; the *Light* impair'd in its Brighneſs, and the *Colour* in its Tincture. And as the Air at ſeveral Times was ſuffered to return into the Receiver again, ſo did the *Light* ſtill become more *pale* and *faint*; though even when the Receiver was quite filled with Air, ſome *feeble Light would ſtill diſcover itſelf*, upon the ſame Attrition given as at firſt.

I find that this purple Light was *viſible no where*, but *only on the Arms of the braſs Spring*, where the Glaſs in its Motion rubb'd upon the Woollen ; and that the Dimenſions of it were about half an Inch in Breadth, and one Inch in Height : And farther, that it did all the while remain ſteady in its Poſition, without any the leaſt Undulation, though the Motion of the Glaſs was ſo conſiderably ſwift.

Some Varieties occurring in the Experiment laſt mentioned, at various Trials.

When this Experiment came to be repeated two or three Times with the ſame Glaſs, no *purple Light* would appear, but a *pale* one only ſucceeded in its Room; neither could I recover the Purple with that *ſame Glaſs*, by any Methods whatſoever that I could uſe.

When I took a *freſh Glaſs*, after I had made uſe of it (this Way) two or three Times, the *Purple was* loſt *again*, and could not be retrieved. And if a new one were us'd, the Effect would ſtill be the ſame.

Sometimes, if the Glaſs were taken out after a violent Attrition, *it would be ſo hot* as *ſenſibly to offend the Hand* that held it; and the Woollen would appear not only *diſcolour'd*, but perfectly *burnt* through.

Sometimes the Light would not be confined to thoſe ſtrict Bounds already mentioned, but would be ſpread quite round the Globe, and *make an entire continued Circle* all the Time of the Motion, notwithſtanding that it touched the Woollen in no more Parts than it did in the former Experiment.

Sometimes a perfect diſtinct *Halo* wou'd appear, ſpreading itſelf quite round the fixed Light. This I attribute to ſome *Particles* of *Water* inſinuating themſelves by the Spindle through the Box on the upper braſs Plate, (where Water is always kept, to prevent the Entrance of Air in that Place:) For this Water deſcending along the *Spindle*, till it reach'd ſome Part which was of a greater Extent, would there (as I conceive) by the Violence of the Motion given, be thrown all about the *Receiver* in *ſmall Drops*; ſome of which being very likely to fall on the Woollen, would there be *heated* to a conſiderable Degree by the Attrition of the Glaſs; and being conſequently *evaporated*, would appear there in the Form of a *Halo*, ſurrounding the Light. And what confirms this Solution is, that having ſince formed a Contrivance to prevent the ſcattering of the Water, no ſuch Appearance of any *Halo* had been obſerved, But to proceed.

In this Experiment I have ſhewn the Effects of the Attrition of *Glaſs* on *ordinary Woollen*; I would now add an Experiment concerning the Attrition of *Glaſs* on *Woollen ſome Way prepared* or qualified before-hand.

I took ſome of the fore-mentioned *Liſt of Cloth*, which had been drench'd in Spirit of Wine, and faſtened it to one Arm of the *braſs Spring*; and ſome of the *Liſt*, which had been ſteeped in Water impregnated with *Saltpetre*, I tied to the other Arm of the ſaid Spring; but both Pieces were well dried before I made uſe of them.

Then upon the Attrition, I obſerved the Light to break upon the agitated Glaſs in a very odd Form, reſembling that of *Lightning*: This is manifeſtly different from the laſt *Phænomenon*; for there indeed we had *delicate purple-colour'd Light*, but here a briſk *fulgurating Light*, ſcattering itſelf about in Flaſhes, and darting with a Force from the Surface of the *revolving Glaſs*.

2. *Concerning the Attrition of Glaſs on Oyſter-Shells.*

Inſtead of the fore-mention'd *Woollen*, I have made uſe of two flat *Oyſter-ſhells* well dried; each Arm of the Braſs had one fixed to it. Upon the uſual Motion given, a Light appeared, reſembling a *fierce flaming Spark*, juſt upon that very Spot where the *Glaſs* and the *Shells* touch'd one another. This Light did not dilate or extend itſelf, but kept within the Bounds where it firſt appeared; and it was but a ſmall Compaſs that it appeared in.

3. *Concerning the Attrition of Oyſter-Shells on Woollen.*

The Succeſs of this Trial was, that it produced a Light, but an *obſcure* and *dim* one, and, at beſt, like a faint *Halo*.

4. *Concerning the Attrition of Woollen on Woollen.*

I took ſome of the *Liſt* formerly mentioned, and bound it about the Edge of a *woollen Wheel*, which I had cauſed to be turn'd for that Purpoſe. This *Wheel* (with its Round of *Woollen*) I faſtened on the Spindle; and ſome of the coarſe Gartering was alſo put about the braſs Spring. The Reſult was, that upon the Motion given (as uſual) a *ſmall glimmering* Light appeared, but ſuch as gave no Proſpect of *being any way improv'd* by the Continuance of the Motion: The *Woollens* were not in the leaſt *diſcolour'd*, though the Friction was ſometimes more than moderate; neither was there any Sign at all of ſuch an Effect, as has been ſhewn to be produc'd by the Attrition of Woollen on other Bodies: The Light (which had been produc'd) totally diſappeared upon the Re-admiſſion of leſs than a quarter Part of the Receiver's natural Content of Air, though the Attrition made then was as great as it had been at any time before.

'Tis further to be obſerved, that I could never find, that the *different Colours* of Woollen contributed any thing to the *different Colours* of *Light*, exhibited in any of theſe Experiments.

The ſeveral Particulars of Fact which we learn from theſe Experiments, are reducible to the following Heads:

That a purple Light was produced by the Attrition of Glaſs on Woollen (in vacuo.)

That the purple Light decay'd, both as to its Tincture and Vigour, upon the Admiſſion of the Air; and did more and more do ſo, as more Air was let in.

That this purple Light is loſt, after two or three ſucceſſive Trials with the ſame Glaſs.

That the Bounds to which the purple Light confines itſelf, are of different and various Extents; reaching ſometimes all round the Globe; *and at other Times* being only about the Place of the Attrition; *but ſtill ſteady, and without Undulation.*

That a briſk fulgurating Light was produced by the Attrition of Glaſs on Woollen impregnated with ſaline and ſpirituous Parts.

That a red fiery Light was produced upon the Attrition of Glaſs on Oyſter-ſhells, which Light was confined within a narrow Compaſs, and did not ſpread itſelf farther about.

That a faint dim Light was produc'd upon the Attrition of Wollen on Oyſter-ſhells.

That a ſmall glimmering Light was produced, upon the Attrition of Woollen on Woollen; which was not increas'd by the Continuance of the Motion, and which diſappear'd upon a ſmall Admiſſion of Air.

That in the Attrition of Glaſs on Woollen, not only a Light, but alſo a great Heat was produced, diſcoverable by the Glaſs, and its Effects on the Woollen too.

And from theſe Obſervations we may make the following Remarks.

Firſt, That *different Sorts of Bodies* afford us remarkably different Lights, different in Colour, and different in Force or Vigour.

Secondly, That the Effects of an Attrition may be various, according to the different Preparation and Management of the Bodies which are to endure it. Thus the Woollen, tinctur'd with Salts and Spirits, gave ſuch a Friction, as produced quite a new Sort of Light.

Thirdly, That Bodies which have yielded a particular Light, may be brought by Friction to yield no more of that Light.

This is plain, from the ſtrange and ſurprizing Loſs of the purple Colour, after two or three Trials made with the ſame Glaſs; for that Purple could not be recover'd by any Art or Means whatſoever.

A pale Light indeed was produceable from the ſame Glaſs afterwards, but the Purple was irretrievably loſt: Therefore the purple colour'd luminous Matter muſt either be quite ſpent, (that is, evaporated and carried off) by the Attrition, or elſe the Configuration and Texture of the Glaſs underwent ſuch a Change by that ſame Action, that it was no longer capable of admitting the purple Light.

If the Cauſe were from the Conſumption of the Matter, then we may reaſon thus: That that certain determinate Quantity of colour'd luminous Matter which is lodged in ſome Bodies, may, by a Courſe of repeated Attritions, be quite exhauſted and carried away.

Further. Becauſe a pale Light is produceable after the other is gone, we may likewiſe upon the ſame Suppoſition argue thus: That ſome Sorts of colour'd luminous Matter are more eaſily ſeparable from Bodies than others; or, that they require different Degrees of Force and Friction, in order to their Evaporation and Diſcharge.

And this is highly reaſonable, ſince the Parts of different-colour'd Lights are undoubtedly of different Magnitudes and Bulks; and conſequently, that Force which may be ſufficient to put ſome of them into vibratory expanſive Motions, may not be ſufficient to produce the like Effects upon others.

On the other Hand, if the Loſs of the Purple was owing to the alter'd Tone or Texture of the Glaſs, then the Concluſion will be, That Bodies may be ſo chang'd by proper Degrees of Friction, as to retain ſome Sort of colour'd luminous Matter, which they did once emit (as here the Purple) and to emit another Sort, which they did at firſt retain; (as in our Caſe, the pale Light.

Now, in Favour of the latter of theſe two, (and as I take it, the only two poſſible) Cauſes, it may be alledged, That the next Experiment will prove to us a Diminution of Light, or a Decay of its Force and Colour, conſequent upon an Attrition: But then, as we ſhall ſee, thoſe Bodies are both hard and inflexible, ſuch as by rubbing would wear and alter one another's Texture: And beſides, the Phænomenon there is only a Diminution or Decay of the Strength and Luſtre of a Colour, a meer gradual Alteration of the ſame Colour, not the Production of a new and different one. On the contrary, in this Phænomenon now before us, one Colour is loſt, and a very different one appears in its Room. And the Attrition here us'd, was that of a ſoft and yielding Body, againſt a hard and inflexible one; ſo that the wearing of the Parts, and the Deſtruction of their Spring or Tone conſequent thereupon, is not here ſo eaſily conceivable: However, upon the whole, I ſhall leave it as a

Qu. Whether the Loſs of the purple Colour be owing to the Conſumption or the Retention of the Matter?

Experiment.

Concerning the Attrition of Glaſs on Glaſs.

Firſt, In Vacuo.

I took a glaſs Globe about three Inches in Diameter, which I fixed to the Spindle; and to the two Arms of the braſs Spring were tied two Slips of thin Board, which had Pieces of a glaſs Tube faſtened to them, by the Means of ſome ſmall nealed Wires which were put through the Cavities. Theſe Wires likewiſe paſſed through ſome Holes in the Board made for that Purpoſe, and ſo kept the Pieces of Tube firm and tight in their Places. All this was cover'd with a large Receiver (as uſual); and the Pump being wrought, the Air was exhauſted.

The great Wheel being then turn'd, a ſwift Motion was given to the included Globe, and by the Friction of this on the forementioned Tubes, a conſiderable Light was produc'd. The whole included *Apparatus* was perfectly diſcernable by it; and the Illumination had been much greater, had not the Day-light prevented; (for it was then but a little paſt Five *P. M.* in the Month of *February*, the Horizon being clear, and the Room open wherein the Experiment was made.) The Colour of the Light produc'd reſembled that of melted Glaſs; and, which is very remarkable, this glowing Colour did not appear only juſt upon the Parts where the Friction was made, but alſo at the Extremities of the Tubes, where the Globe did not touch 'em.

Secondly, In leſs rarified and common Air.

The Air being ſuffered to enter the Receiver by Degrees, and at ſeveral Times, the Motion was given at each of thoſe Ingreſſes of the Air; and the Phænomenon here obſerved was, that no ſenſible Decay of Light or Colour was to be diſcovered at any of thoſe Times, except only that at laſt, when the Tubes by much rubbing were worn, and conſequently their Spring leſſen'd and impair'd, then indeed the Light would be diminiſhed in Proportion to the Abatement of their Force on the moving Body. And this I have often obſerved, when the Motion has been made for ſome time *in vacuo*, or in common Air: So that I queſtion not, but if the Experiment had been begun where it ended, (in this Trial,) the leſſer Light would then have been exhibited *in vacuo*; (that is, had the Experiment been made, even *in vacuo*, with Tubes thus rubb'd and worn, and conſequently their Spring weakened, a leſs Light would have been produced, than if the Experiment had been made *in pleno*, with Tubes not thus weaken'd and impair'd by the Attrition.)

N. B. I have ſince tried the ſame Experiment *in vacuo*, and that about Noon, in a clear Day; and I found, that the Light was even then as ſenſible as that of a Piece of red hot Glaſs of the ſame Bigneſs would have been, in the open Air: Yet this Appearance, as diſcernable as it is, continues not any longer than the Motion is continued.

By this Experiment we learn,

Firſt, That a conſiderable Light is produceable by the Attrition of Glaſs on Glaſs, (that is, of ſome Sorts of hard Bodies, on others of the ſame Kind) *in vacuo*.

Secondly. That the Light continues unalter'd upon the Admiſſion of Air.

Corol. We may ſee the Difference therefore between this Light here produc'd, and thoſe mentioned in other Experiments: For this endur'd without Change the Shock of the returning Air; whereas moſt or all of thoſe formerly recited, underwent ſeveral gradual Alterations, according to the Degree of the Air's Admiſſion.

Thirdly, That when the Tubes were worn by the Friction, there was an Abatement of the Light, and the more wearing the more Abatement.

Corol. We may ſee from hence, how much the due Spring and Tone of the Parts contributes to the Emiſſion of Light in thoſe Bodies which will emit it: So that we may reaſonably believe in general, that very great Alterations may be wrought in Bodies as to their luminous Qualities and Properties, either leſſening and deſtroying them on one Hand, or perhaps increaſing and improving them on the other, by the Actions of other contiguous Bodies upon them, according as thoſe Actions tend either to the weakening or confirming the Spring and Tone of their Parts.

I have only two Obſervations to make farther with Regard to this Experiment.

Firſt, That the Glaze or Poliſh on the Surface of a Glaſs adds nothing to the Light, as far as I can find by any Obſervation.

Secondly, That though this Colour be like that of red-hot or melted Glaſs, yet the Glaſs is not really in ſuch a State as to be red hot, becauſe this Colour never out-lives the Motion, but is gone preſently upon the ceaſing of it, (as has always been obſerved in the darkeſt Night;) whereas if it were really red-hot with the Motion, the Appearance muſt neceſſarily be preſerved for ſome ſmall time, at leaſt.

Experiment.

Concerning the Attrition of Glaſs on Glaſs, under Water.

This is no more than a Repetition of the laſt Experiment in another *Medium*; for the whole *Apparatus* (there mentioned) was now intirely immerſed in Water. Upon the firſt Friction of the Globe on the Tubes, a pretty briſk Light was produced which enlighten'd the whole Body of the Water. The Parts of the Tubes where the Friction was made, were diſtinguiſhably red; but the Appearance ſoon began to leſſen, and in no long Time quite died away; for the Water grew thick and turbid, by the Grit or Powder of the Glaſſes which was worn off by the Attrition. It approach'd continually nearer and nearer to the Colour of Whey, ſo that the Light could be but juſt diſcover'd as glimmering through the Body of it; and that not continually neither, but with Interruption, and like faint Flaſhes ſent out at a Diſtance. Tho' at ſome other Trials, I have obſerved the Light to be more conſiderable than it was at this Time.

The Duſt rubb'd off by the Attrition of the Glaſſes, I view'd through a good Microſcope; the Particles of it appear'd to be of a long and ſlender Figure, but I could not diſcover the leaſt Sign of their having been any Way in *Fuſion* or *melted.*

We ſee therefore, that Light is produceable by the Attrition of Glaſs on Glaſs; not only *in vacuo*, and common Air, but alſo in Water too. And hence it is evident further, that the Glaſſes are not heated red-hot by the Attrition, whatever ſuch Reſemblance the Colour carries along with it.

An Experiment concerning the Production of a conſiderable Light, upon a ſlight Attrition of a Glaſs Globe exhauſted of its Air.

I took a glaſs Globe of about nine Inches Diameter, and exhauſted the Air out of it; then (having turn'd a Cock, which prevented the Return of the Air,) I took it from the Pump. The Globe being thus ſecured, I fixed it to a Machine, which gave it a ſwift Motion with its Axis perpendicular to the Horizon; and then applying my naked Hand (expanded) to the Surface of it, the Reſult was, that in a very little Time a conſiderable Light was produc'd. And as I mov'd my Hand from one Place to another, (that the moiſt *Effluvia*, which very readily condenſe on the Glaſs, might, as near as I could, be thrown off from every Part of it.) By this Means the Light improv'd, and ſo continued to increaſe, till Words in Capital Letters became legible by it; (as has been obſerved by Spectators). Nay, I have found the Light produc'd to be ſo great, that a large Print without much Difficulty might be read by it; and at the ſame time, the Room, which was very large and wide, became ſenſibly enlighten'd, and the Wall was viſible at the remoteſt Diſtance, which was at leaſt ten Feet. The Light was of a curious purple Colour, and was produc'd by a very ſlender Touch of the Hand; the Globe at the ſame time being ſcarce ſenſibly warm; neither could I ever find, that a more violent Attrition did contribute any thing to the Increaſe of the Light.

Now after this Attrition of the exhauſted Globe had been continued for ſome time, the Cock was turn'd, which gave Liberty to the Air to enter into the Globe through the Joints of the Screws; the Motion of the great Wheel, and the Application of the Hand, continuing all the while as before. Then I obſerv'd, that as the Cavity of the Globe became more and more repleniſh'd with Air, ſo the Mode of the Light continued to alter, till the ſame Quantity of Air was re-admitted as had been exhauſted. And when ſuch a Quantity was once enter'd, there was then as great a Difference between that Light and the Light produc'd when the Globe was empty of Air, as between the Lights produc'd from Mercury, when the Experiment was made *in vacuo*, and the open Air: For if a Man touched the Globe with his Fingers, there were Specks of Light (though without any great Luſtre) ſeen to adhere to them. Nay, while my Hand continued upon the Glaſs, (the Glaſs being in Motion,) if any Perſon approach'd his Fingers towards any Part of it in the ſame horizontal Plane with my Hand, a Light would be ſeen to ſtick to them at the Diſtance of an Inch or thereabouts, without their touching the Glaſs at all, as was confirmed by ſeveral then preſent. And it was obſerved alſo, that my Neckcloth, at the ſame time at an Inch or two diſtant from the Globe, appeared of a fiery Colour, without any Communication of Light from the Globe.

This was the Event of this Experiment at the firſt Time of making it; in which Caſe the Air was let into the exhauſted Globe all at once.

But at the ſecond Time of making this Experiment, the Air was not let in all at once, (as before,) but gradually and at ſeveral Times; by which Means the Modes of Light produced in the ſeveral different *Mediums* were the better obſervable; though it muſt be own'd, that here was no great Alteration of the Light either as to its Vigour or

Colour, till ſo conſiderable a Quantity of Air was let in as amounted to more than one quarter Part of the Globe's natural Content. But many times before half its Content (as near as I could gueſs) was let in, the Light began to branch itſelf into pleaſant Figures, from that Side of the Globe touch'd by the Hand; ſo that the whole Body of the Globe was filled with theſe fine Appearances: And as much Air was admitted, ſo the Stems of thoſe Branches of Light became more and more ſlender and minute, ſtriking then alſo againſt the oppoſite Side of the Glaſs, and rebounding from thence in a Manner very ſurpriſing and delightful to behold; till at length more Air ſtill being let in, the Light and the Figures both diminiſhed, and continued ſo to do, till the Appearance became the ſame as was related at the Concluſion of the firſt Trial.

I would only note here, that what Difference ſoever there was, as to the latter Parts of theſe two Trials, the former Parts of both were alike; except only, that in the ſecond Trial, upon the Application of a Piece of white Sheep's Leather, a good Light was produced while it was held to the Globe with the Wooll Side next it; but when it was turned with the other Side to the Globe, though it was continued thus expos'd for ſome time, yet no Light appeared: But then turn it again, and the ſame Light would appear as at firſt. And thus it happened upon ſeveral Times repeating the ſame.

Having taken Notice (in the Experiment now recited) that the higheſt Degree of Rarefaction of the Air in the Globe, is by no Means neceſſary to the Production of this Light, ſince it would be very little leſſened, either as to Vigour or Colour, till (perhaps) more than one fourth Part of the Air was let in: I would add further, That I have often obſerved the ſame Thing, as to the Light produced in the mercurial Experiments; though the Colour indeed was not the ſame; for in thoſe Experiments it was always pale. And ſince in thoſe Experiments with Mercury, there is ſuch a ſeeming Congruity of Appearances, in all Circumſtances, with thoſe made on the Attrition of Glaſs without it, one might conjecture with ſome Probability, that the Light produc'd proceeds from ſome Quality in the Glaſs, (upon ſuch a Friction or Motion given it) and not from the Mercury upon any other Account, than only as it is a proper Body, which, by beating or rubbing on the Glaſs, produces the Light. And that which ſeems to back ſuch a Conjecture, is, that having rubbed the upper or empty Part of a mercurial Barometer between my Fingers, a Light followed upon it without any Motion of the Quickſilver. But notwithſtanding all this, the Matter is doubtful; and there may (for all we know) be a luminous Quality in Mercury, as well as in Glaſs or other Bodies; which the following Experiment (purpoſely made) ſeems to countenance.

I took a ſmall Quantity of Quickſilver, and put it into a Gallipot where Varniſh had often been uſed, by which Means the Pot was pretty well lined with it; the Winter at that Time was moiſt, which influenced the Varniſh ſo far as to ſoften it a little; now when this Gallipot, with its contained Mercury, came to be *in vacuo*, as ſoon as the Pump was ſhook, a Light appeared, and this without any Concurrence of Glaſs, or the Aſſiſtance of a more proper or favourable Seaſon. I purpoſely mention the Moiſture of the Weather, becauſe a humid Air would ſometimes render the Experiment unſucceſsful, even in Glaſs, or at leaſt take off very much from the Appearance of it.

Farther, I am inform'd by ſeveral Perſons of Credit, that *Mercurius dulcis*, if broken in the Dark, would yield notable Flaſhes of Light. But ſince the Mercury in that Preparation is pointed with Salts, (and each Globule of it conſequently wrapt up in the ſame) a Man cannot be ſure that the Salts do not contribute to the Phænomenon: For I have often obſerved, that Loaf-Sugar, when ſtruck or broken in the Dark, affords a Light; and I can't tell but Salts, as cloſely united in their Parts as Sugar, may, upon a violent Separation of them, do ſo likewiſe. But this I intend to enquire into by ſome farther Trials, *viz. Firſt*, I deſign to try, whether *Mercurius dulcis* will afford any Light, when broken *in vacuo*; ſince if it proceeds from the Mercury, and there be ſuch a Quality in that Body, 'tis highly reaſonable to expect it then, ſo rare a Medium being the moſt proper to diſcover it in. *Secondly*, What the Salts will do without Mercury, both in the open Air, and *in vacuo*; for there are ſome Bodies which appear luminous in the open Air, and yet totally loſe that Quality *in vacuo*. As for Inſtance; I took a Piece of Wood (which I ſuppoſe had lain under Ground a conſiderable time) very moiſt, but not rotten. In the Dark it appeared very vividly of the Colour of Fire; but having incloſed it in a Receiver on the Pump, I found that as the Air was withdrawn, the fire-like Appearance proportionally decayed; till at laſt *in vacuo*, it became perfectly void of Light; and then as the Air was let in again, ſo it recovered its firſt Brightneſs. This I repeated ſeveral Times with the like Succeſs.

But to return now to the Experiment. The Matters of Fact to be obſerved from thence, are reducible to the following Heads.

The Production of a Light by the Friction of the Hand on the Surface of the exhauſted Globe.

The great Improvement and Increaſe of this Light, by the Motion of the Hand from one Place to another.

The Slightneſs of the Friction requiſite to produce this Light; *and 'tis not increaſed by a more violent one.*

The Alteration of the Light, upon the Re-admiſſion of the Air.

The Continuance of that Alteration, as more and more was admitted.

The Light's communicating itſelf to Bodies placed near it, when the whole Quantity of Air drawn out was re-admitted.

This, when the Air was let in gradually; *then no great Change of the Light, as to Colour or Vigour, till more than* 1 4*th of the Globe's natural Content of Air was admitted.*

The wonderful Figures, Branchings, and Reverberations of the Light, as more Air was let in, till it came to the Bounds of a certain Quantity of Air admitted, where the Appearance was at the Height.

The gradual Diminution both of the Light and Figures, (after it was come to that Limit) upon the Admiſſion of more and more Air.

An Experiment concerning the Electricity of Glaſs, diſcovering itſelf in an extraordinary Manner, upon a ſmart Attrition of it.

Having procur'd a Tube, or hollow Cylinder, of Flint Glaſs, about one Inch Diameter, and thirty in Length, I rubb'd it pretty vigorouſly with Paper in my Hand, till it had acquired ſome Degree of Heat. I then held it towards ſome Pieces of Leaf-braſs; which were no ſooner within the Sphere of

Activity of the Effluvia emitted by the Tube, but they began to be put into briſk Motions, and yielded the following ſurpriſing Appearances.

They would leap towards the Tube at a very conſiderable Diſtance from it; nay, I have found, that ſometimes the Diſtance of 12 or more Inches has not prevented their doing ſo.

Sometimes they would adhere and faſten to the Tube, ſettling themſelves on its ſurface, and there remain quiet; and ſometimes they would be thrown off from it with a very great Force, even to the Diſtance of ſix or ſeven Inches; and not only when they adhered to the Surface of the Tube, would they thus ſuddenly and precipitately be drawn from it; but alſo in their Motion of Aſcent towards it, even when they were advanced ſo far as to touch the Tube, this repellent Force would take Place, and hurry them downwards with a great Velocity.

And (which ſtill adds to the Wonderfulneſs of the Phænomenon) they would often repeat the alternate riſing and falling; the attractive and repulſive Forces (whatever they are) exerting themſelves as it were by Turns; the one drawing up, and the other beating down thoſe light Bodies, and that for ſeveral Times one after the other.

Neither is this all the Variety which the Phænomenon afforded; for ſometimes they would move but ſlowly towards the Tube, ſometimes they would remain a ſmall Time ſuſpended between the Tube and the Table in which they were firſt laid; and at other Times (which is no leſs ſtrange than the former) they would ſeem to ſlide along in the Direction of the Sides of the Tube, and that without touching it.

But beſides theſe, there are yet ſome other Obſervations relating to this Experiment, which I think not amiſs here to mention,

Firſt, The hotter the Tube was made by rubbing, to the greater Force did the attractive Force extend itſelf. But that it will anſwer in Proportion to any Degree of Heat excited, is what I will not venture to determine. I mean, whether, increaſing ſtill the Degree of Heat in the Tube, the Sphere of the attractive Power will ſtill be proportionably enlarged; or whether there may not be ſome certain Degree of Heat, which may carry the Attraction to its utmoſt Limits of Diſtance, ſo that all Degrees above that ſhall produce leſs powerful Effects this Way. Whether this be ſo or no, (I ſay) is a Point which will require farther Trials, and more Conſideration, in order to a compleat Deciſion of it.

Secondly, Though all the various Appearances now mentioned, as to the Motion of the attracted little Bodies, do not happen at every Time and Trial, yet many of them are obſervable at all Times; neither are there any hinted, but what I have at ſome time or other punctually obſerved. And the Reaſon of this Difference ſeems very probably to ariſe from the different Temper and Conſtitution of the Air: For when the Air is clogg'd either with humid and aqueous, or other more groſs and ſolid Parts, rais'd up from the vaſt Fund of terreſtrial Matter here below, there's no Doubt but the Reſiſtance theſe fine Effluvia then meet with in their Way, muſt be much greather than when the Air is free, and no ſuch Impediments lie to oppoſe them in their Paſſage; for the Effluvia, how ſubtile ſoever they may be imagined to be, are yet Body and Matter, and muſt therefore be liable to the common Laws of Bodies, which is to be reſiſted in ſome Proportion to the Strength and Denſity of the *Medium*. Neither is is improbable, but that in a moiſt Conſtitution of the Air, the watry Parts may run together, and condenſe on the Surface of the Tube, and ſo choak up and obſtruct the Paſſage of the Matter, which otherwiſe would be emitted very vigorouſly from thence. And indeed, I have always obſerved, that Moiſture is a great Enemy to all Experiments of this Kind; the Reaſon of which, I think, is pretty obvious from what was juſt now hinted about the Reſiſtance.

ATTURNEY, or *Attorney*, in a legal Acceptation, ſignifies one appointed by another Man to do any thing in his Stead, and is as much as *Procurator* or *Syndicus* in the Civil Law; or *Attorneys* are ſuch Perſons, as are by the Conſent, Commandment or Requeſt of another, to take heed, ſee to, and to take upon them the Charge of another Man's Buſineſs in his Abſence.

AVANT *Foſſe*, or *Ditch of the Counterſcarp*, in *Fortification*, is a Moat or Ditch full of Water running round the Counterſcarp on the Outſide next the Campaign at the Foot of the *Glacis*. It is not eligible to have ſuch a Water Ditch where it can be drained dry; becauſe it is a Trench ready made for the Beſiegers to defend themſelves againſt the Sallies of the Beſieged. Beſides, it hinders putting Succours into the Place, or at leaſt makes it more difficult ſo to do.

AVAST, a Word uſed very commonly aboard a Ship, ſignifying to ſtop, hold or ſtay.

AUDIENCE *Court*, is a Court belonging to the Archbiſhop of *Canterbury*, of equal Authority with the *Arches Court*, though inferior both in Dignity and Antiquity.

AUDIENDO & *Terminando*, is a Writ, but more properly a Commiſſion, directed to certain Perſons, when any riotous Aſſembly, Inſurrection, or heinous Miſdemeanour or Treſpaſs is committed againſt any Place.

AUDITA *Querela*, is a Writ that lies where one is bound in a Statute or Recognizance, or where Judgment is given againſt him for a Debt, and his Body in Execution thereupon; for if he have a Releaſe, or any other ſufficient Diſcharge, but has no Day in Court to plead it, then he ſhall have this Writ againſt him which hath recovered, or againſt his Executors.

AUDITOR, according to our Law, is an Officer of the King or ſome other great Perſon, which yearly, by examining the Accounts of all Under Officers accountable, makes up a general Book; with the Difference between their Receipts and Charge, and their Allowances, commonly called *Allocations*; as namely, the Auditors of the Exchequer take the Accounts of thoſe Receivers, who collect the Revenues of the Augmentation, as alſo of the Sheriffs, Eſcheators, Collectors, and Cuſtomers, and ſet them down, and perfect them.

AUDITOR *of the Receipts*, is an Officer of the Exchequer that files the Teller's Bills, and makes an Entry of them, and gives the Lord Treaſurer a Certificate of the Money received the Week before. He maketh *Debentures* to every Teller, before they pay any Money, and taketh their Accounts: He keepeth the *Black Book of Receipts*, and the Treaſurer's Key of the Treaſury, and ſeeth every Teller's Money locked up in the new Treaſury.

AUDITORS *of the Preſt or Impreſt*, are Officers in the Exchequer, who take and make up the great Accounts of *Ireland*, *Berwick*, the *Mint*, and of any Money impreſt to any Man for the King's Service.

AUDITORY *Nerve*, is the ſeventh Pair of Nerves that comes from the *Medulla oblongata*, ariſing from the hinder Part of the *Proceſſus annularis*; it enters the Hole in the inner Proceſs of the *Os petroſum*. It is divided into two Branches; that which is ſoft is called *Portio mollis*, and it is diſtributed into the Labyrinth, *Cochlea*, and the Membranes which cover the Cavities of the Ear. That which is hard, is called *Portio Dura*; it goes out of the Ear by the Hole which is between the *Proceſſus maſtoides* and *Styloides*, it is divided into two Branches, of which one goes to the Muſcles of the Tongue, or *Os Hyoides*, and it gives a ſmall Branch to the eighth Pair; the other is diſtributed in the external Ear, Noſe, Lips, and Cheeks.

AVE; ſee *Aile*.

AVELLANE, the Form of a Croſs which the Heralds give us, which reſembles four Filberds in their Husks or Caſes joined together at the great End; from whence it ſeems to take its Name, for a Filberd is *Nux avellana*.

AVENTURE, but more properly *Adventure*, is a Term in Law ſignifying a Miſchance, cauſing the Death of a Man without Felony, as when he is ſuddenly drowned or burnt, falling into the Water or Fire, or killed by any Diſeaſe or Miſchance.

AVENUE, [in *Fortification*,] is an Opening or Inlet into any Fort, Faſtion, or ſuch like Place.

AVERAGE, [in *Law*,] is that Service which the Tenant owes to his Lord, to be done by the Beaſts of the Tenant.

It alſo ſignifies a certain Contribution which Merchants and others pay proportionably towards their Loſſes that have their Goods caſt away in a Tempeſt, for the ſaving of the Ship or Goods, or the Lives of them that are therein.

AVERCORN, was anciently a reſerved Rent in Corn paid to Religious Houſes by their Tenants or Farmers.

AVERIIS *captis in Withernam*, is a Writ for the taking of Cattle to his Uſe, that hath his Cattle unlawfully taken by another, and driven out of the County where they are taken, that they cannot be replevy'd.

AVERMENT, [in *Law*,] is where a Man pleads a Plea in Abatement of the Writ, or a Barr of Action, which he ſays he is ready to prove, as the Court will award. This Offer to prove the Plea is called an *Averment*.

AVER PENY, is to be quit of divers Sums of Money for the King's Arrearages.

AVERRUNCATION, [in *Agriculture*,] ſignifies the lopping off ſuperfluous Branches.

AUGE, an Aſtronomical Term, the ſame as *Apogæum*, is that Point of the Orbit, wherein a Planet being, is furtheſt diſtant from the central Body about which it revolves, and is then ſloweſt in Motion, inſomuch that from this Point the Diſtance of a Planet is reckoned, to find thereby the Inequality of its Motion.

AUGMENTATION, was the Name of a Court erected by King *Henry* the Eighth, for the Increaſe of the Revenues of the Crown, by the Suppreſſion of the Abbies and Religious Houſes: This Court was diſſolved in Queen *Mary*'s Reign; but the Office of *Augmentation* remains to this Day, wherein there are many Records of great Uſe and Importance.

AUGMENTATIONS, [*in Heraldry*] are additional Charges frequently given as a particular Mark of Honour, and generally borne on an Eſcutcheon or Canton.

AUMONE, (Tenure in *Aumone*,) is a Tenure *per liberam Eleemoſynam*, as where Lands are given to ſome Church or Religious Houſe, upon Condition that ſome Service or Prayers ſhall be offered at certain Times for the Good of the Donor's Soul.

AVOIDANCE, [in *Law*,] is when a Benefice becomes void of an Incumbent, which may be by Death, Ceſſion, Plurality, Deprivation, Deſignation, &c.

AVOIR DU POIS, in *French*, ſignifies to be of juſt Weight; but in Law it is taken in two Senſes, for a peculiar Kind of Weight of 16 Ounces to the Pound, and thereby diſtinguiſhed from *Troy* Weight, whoſe Pound hath but 12 Ounces: And alſo ſuch Merchandize and Goods as are weighed by this Weight, and not by *Troy* Weight, are *Pitch*, *Tar*, *Roſin*, *Wax*, *Fleſh*, *Tallow*, *Cheeſe*, *Soap*, *Hemp*, *Flax*, *Copper*, *Tin*, *Lead*, *Steel*, *Iron*, &c. Mr. *Ward* ſaith, he found that 1 Pound *Avoirdupois* was exactly 14 Ounces 11 Penny-weight, 15 Grains and a half *Troy*: And he ſaith, he can find no Law for the Introduction of this Weight, nor at what Time it came into Uſe, which it ſeems to have done only by Cuſtom. See *Weights*.

AVOWEE, is he to whom the Right of *Advowſon* of any Church appertaineth, ſo that he may preſent in his own Name; and is called *Avowee*, for a Difference from thoſe that ſometimes preſent in another's Name, as a Guardian that preſenteth in the Name of his Ward: And alſo to be diſtinguiſhed from thoſe which have the Lands whereunto an *Advowſon* appertaineth, but only for Term of their Lives, of Years, or by Intruſion, or by Diſſeiſin.

AVOWRY, [a *Law Term*,] is, when one takes a Diſtreſs for Rent or other thing, and the other ſues *Replevin*; now he that took the Diſtreſs juſtifying the Act, is ſaid to *avow it*.

AURICULÆ *Cordis*, are two *Appendages* to the Heart, ſeated at its Baſis over the Ventricles; they are ſo called, from ſome Reſemblance that they bear to the Ears of a Man's Head. They ariſe from a long Baſis, and end in an obtuſe Point, thereby forming an obtuſe Triangle. They are of the ſame Fabrick and Uſe with the Ventricles over which they ſtand, being Muſcles as they are, made up of the ſame Order of Fibres, which are carried into oppoſite Tendons; whereof that at the Baſis of the Heart is common to it and the *Auriculæ*, and the other runs along their upper Part. The Right *Auricle* is larger and ſofter than the Left. The Superficies of both is ſmooth when they are full, but wrinkled when empty, and more ſo in the Left than in the Right one. On being cut open, they exhibit many fleſhy Columns running from the Upper Tendon to the Lower, and between them there are pretty deep Furrows or long Cavities, but fewer in the Right *Auricle* than in the Left. They are dilated and contracted in like Manner as the Heart is, but at different Times; for the *Syſtole* of the Ventricles is at the ſame time with the *Diaſtole* of the *Auricles*, and *vice verſa*; ſo that the *Auricles* are receiving their Blood from the Veins, while the Ventricles are expelling theirs into the Arteries: But when the Ventricles are relaxed and empty in their *Diaſtole*, then the *Auricles* force the Blood into them by their *Syſtole*. They are nouriſhed by Branches of Arteries ſpringing from the *Coronaria*, which Doctor *Ruyſch* (who ſeems firſt to have taken Notice of this) calls therefore *Arteriæ Auriculares*, and no Doubt but they have Branches alſo of Veins to attend them. Their Uſe is to receive the Venal Blood which comes immediately out of the *Vena cava* and *Pulmonaris*, and to meaſure, as it were, ſaith *Gibſon*, into the Ventricles; and to expel it thither with the greater Force, the internal Fibres or Columns of their Cavity ariſing from their Root where they are joined to the Baſis of the Heart, reach directly outwards towards the *Vena cava* and *Pulmonaris*; and in the *Diaſtole* of the *Auriculæ*, graſp the Blood contained in their Cavities like ſo many Fingers, and ſqueeze it into the Ventricles, now relaxed in their *Diaſtole*.

AURICULARIS *Digitus*, [*Anatomy*,] the little Finger, ſo called, becauſe it is uſed commonly to pick the Ear. *L.*

AURIGA, [in *Aſtronomy*,] the *Waggoner*, a Conſtellation of Fixed Stars in the Northern Hemiſphere. See *Star* and *Conſtellation*.

The Stars in the Conſtellation *Auriga*, in *Ptolemey*'s Catalogue are 14, in *Tycho*'s 23, and in the *Britannick* Catalogue 68.

AURIPIGMENTUM, *Yellow Arſenick*.

AURISCALPIUM, is an Inſtrument to clean the Ears.

AURORA *Borealis*, is a white pyramidal Glade of Light, which Dr. *Childry*, Mr. *Caſſini*, and Mr. *Derham* have mentioned as appearing like the Tail of a Comet in the Northern Hemiſphere of the fixed Stars.

Aurora Borealis, or *Aurora Septentrionalis*, the *Northern* Dawn or Light, is an extraordinary Meteor or luminous Appearance, ſhewing itſelf in the Night-time in the Northern Part of the Heavens.

It is uſually of a reddiſh Colour inclining to yellow, and ſends out frequent Coruſcations of pale Light, which ſeem to riſe from the Horizon in a pyramidal undulating Form, and ſtrike with great Velocity, up to the Zenith.

This Kind of Meteor never appears near the Equator, and was ſo rare in *England*, that none are recorded in our Annals ſince that remarkable one, *Novemb.* 14, 1574, till the ſurprizing *Aurora Borealis*, *March* 6, 1716, which appeared for three Nights ſucceſſively, but by far more ſtrongly on the firſt. Indeed, in the Years 1707 and 1708, five ſmall ones were obſerved in little more than eighteen Months.

Hence it ſhould ſeem that the Air, or Earth, or both, are not at all times diſpoſed to produce this Phænomenon; for tho' 'tis poſſible it may happen in the Day-time, in bright Moon-ſhine, or in cloudy Weather, and ſo paſs unobſerved; yet that it ſhould appear ſo frequent at ſome times, and ſo ſeldom at others, cannot well this Way be accounted for. That in *March* 1716, was viſible to the Weſt of *Ireland*, Confines of *Ruſſia*, and to the Eaſt of *Poland*; extending at leaſt near 30° of Longitude, and 50° in Latitude; that is, over almoſt all the North of *Europe*; and in all Places at the ſame time, it exhibited the like wondrous Circumſtances.

A ſufficient Number of Obſervations have not yet been made by the Curious, to enable them to aſſign the Laws of this Phænomenon, with any Certainty. Dr. *Halley* however, imagines that watry Vapours, or *Effluvia*, rarified exceedingly by ſubterraneous Fire, and tinged with ſulphurous Steams, which *Naturaliſts* ſuppoſe to be the Cauſe of Earthquakes, may alſo be the Cauſe of this Appearance; or, that it is produced by a Kind of ſubtile Matter, freely pervading the Pores of the Earth, and which entring into it near the South Pole, paſſes out again with ſome Force into the *Æther* at the ſame Diſtance from the North Pole; the Obliquity of its Direction being proportioned to its Diſtance from the Pole. This ſubtile Matter, by becoming ſome Way or other more denſe, or having its Velocity increas'd, may be capable of producing a ſmall Degree of Light, after the Manner of *Effluvia* from electrick Bodies, which by a ſtrong and quick Friction, emit Light in the Dark: To which Sort of Light this ſeems to have a great Affinity. *Philoſ. Tranſ.* N°. 347.

AURUM *Fulminans*, or *Saffron of Gold*, is thus made; put a Drachm of thin Plates of Gold into a Matraſs, and then pour on it by little and little (or elſe there will be ſo great an Efferveſcence, that the Matter will boil over the Glaſs) 3 or 4 Drachms of *Aqua Regalis*. Set the Matraſs in warm Sand, and when the Ebullitions are over, the *Menſtruum* will have diſſolved as much of the Gold as it can contain. Pour off the Solution by Inclination into another Glaſs, and then pour into the Mixture gradually ſome of the *Volatile Spirit* of *Sal Armoniack*, or Oil of *Tartar per deliquium*, and the Gold will precipitate to the *Bottom* of the Glaſs: Let it ſtand a while till all is fallen down, then pour off the Liquor, and waſh the Powder carefully with warm Water, till it grows inſipid: Then dry it in a Paper by a gentle Fire, taking Care it do not fire, which it is apt to do with a terrible Noiſe. If you diſſolve a Drachm of Gold, there will be four Scruples of *Aurum Fulminans* well dried. It takes its Name from its *fulminating*, or making a great Noiſe like Thunder, when it is heated over the Fire in a Spoon, for it will go off like a Gun, but without doing any Miſchief its Force being chiefly downward. The Effect ſeems to come from ſome Parts of the *Aqua Regalis*, which remain ſtill ſticking in the Gold, and theſe being of a very *ſpiritous* and *volatile Nature*, do break out with great Violence when the Powder comes to take Fire.

Thoſe who would know a Way to make as great, but yet a much leſs expenſive Noiſe, may ſee the Word *Pulvis Fulminans*. If half its Weight of *Sulphur* powdered be mingled with *Aurum Fulminans*, its *fulminating Quality* will be deſtroyed.

Though on ſeveral Trials deſignedly made to make Gunpowder take Fire in Mr. *Boyle*'s exhauſted Receiver, it could not be effected, yet he found that *Aurum Fulminans* would take Fire *there*, and go off, both by Means of a burning Glaſs, and of a Piece of hot Iron.

AURUM *Moſaicum*, is made by mixing and ſubliming Mercury, Tin, Sulphur, and Sal Armoniack all together.

AURUM *Potabile*: The *Alchymiſts* pretend to be able to ſeparate the *Salt* and *Sulphur* of Gold, and then diſſolving it in a Liquor, it may be drank, and therefore is called *Aurum Potabile*: But this is a meer Impoſture, the *Aurum Potabile* being nothing uſually but ſome rich Cordial Liquor with Pieces of Leaf Gold in it.

AUSTERE *Taſte*, is ſuch an one as moderately conſtringes the Mouth and Tongue with ſome Aſperity; as is the Taſte of Unripe Fruits.

AUSTRAL, the ſame with *Southern*: Thus, AUSTRAL *Signs*, are the ſix laſt Signs of the *Zodiack*; ſo called, becauſe they are on the *South* Side of the *Equinoctial*.

AUTHENTICKS. The Word *Authentick* ſignifies *of good Authority*; and therefore the 3d Volume or Tome of the Civil Law, is called *The Authenticks*, from the *Greek* Word αὐθεντεῖν, becauſe it hath its *Authority* from itſelf, and proceeding from the Emperor's own Mouth; or elſe that they are Originals to other Writings which are tranſcribed out of them, They are a Volume of new Conſtitutions ſet out by *Juſtinian* the Emperor, after the *Code*, and brought into the Body of the Law, under one Book.

There is not in theſe that good Order and Method obſerved, as there is in the *Code*, or in the *Digeſt*; but as any doubtful Point came to be conſidered, you have here the Prince's Determination of it; and that ſet down as the Caſes occaſionally occurred.

The whole Volume is divided into nine *Collations*, *Conſtitutions*, or *Sections*, (I mean in the *Latin* Verſion, for in the *Greek* there is not this Diviſion into *Collations*,) and theſe are ſubdivided into 168 *Novels*, each of which is diſtributed into ſeveral Chapters. They are called *Novels*, becauſe they were *new Laws* in Compariſon of the *Code* and *Digeſt*; juſt as the Conſtitutions of the Empepors which were newly publiſhed after the *Baſilica*, were called the Novels of *Leo*, *Nicephorus*, *Michael*, &c.

AUTOGRAPHY, ['Αυτογραφία, of αὐτὸς, *his own*, and γραφὴ, *Gr. Writing*,] is the peculiar Hand Writing of any particular Perſon; or the Original of any Treatiſe or Diſcourſe in reſpect of a Copy.

AUTOMATA, [of 'Αυτοματὸς, *Gr. ſpontaneous*,] are mechanical or mathematical Inſtruments or Engines, that going by a Spring, Weights, *&c.* ſeem to move of themſelves, as a Watch, Clock, *&c.*

AUTOPSY, ['Αυτοψία, *Gr.*] is ocular Inſpection, or ſeeing any thing with our own Eyes.

AUTUMN, [with *Alchymiſts*,] the Time or Seaſons when the Operation of the *Philoſopher's Stone* is brought to Maturity.

AUTUMNAL *Point*, [*Aſtronomy*,] is one of the *Equinoctial Points*, being that from which the Sun begins to deſcend towards the *North* Pole.

AUTUMNAL *Equinox*, [*Aſtronomy*,] the Time when the Sun is in the *Autumnal Point*.

AUTUMNAL *Signs*, [*Aſtronomy*,] are thoſe through which the Sun paſſes during the *Autumn*.

AUXILIARY *Verbs*, in *Grammar*, are ſuch as help to form or conjugate others; as *to have* and *to be* in the *Engliſh Tongue*, *eſtre* and *avoir* in the *French*, *Italian*, *Spaniſh*, &c.

AUXILIUM *ad filium militem faciendum & ad filiam maritandam*, was a Writ formerly directed to every County, where the King or other Lord had Tenants, to levy of them a reaſonable Aid towards the Knighting of his Son, and Marriage of his Daughter; but this is now utterly taken away by a Statute made 12 *Car.* 2. *c.* 24.

AUXILIUM *Curiæ*, a Precept or Order of Court, for the citing or convening of one Party at the Suit of another.

AUXILIUM *petere*, in *Law*, ſignifies to pray Suit in a Cauſe; that is, when an inferior Tenant is impleaded, and not capable to defend the Right in his own Name; he prayeth Aid of the ſuperior Lord to aſſiſt and juſtify his Plea.

AUXILIUM *Regis*, King's Aid, or Money levied for the King's Uſe, and publick Service.

AUXILIUM *Vicecomitum*, the Aid or cuſtomary Dues paid to the Sheriff, for the better Support of his Office.

AWARD, [a Term in *Law*,] properly ſignifying the Judgment of one that is neither aſſigned by Law, or appointed by the Judges for the ending a Matter in Controverſy, but is choſen by the Parties themſelves that are at Variance.

AWN, in *Botany*, *Ariſta*, is the Beard growing out of the Husk of Corn or Graſs.

AWNING, aboard a Ship, is when a Sail, a Tarpaulin, or the like, is hung over any Part of the Ship above the Decks, to keep off the Sun, the Rain, or the Wind. In a *Long-boat*, they make an *Awning*, by bringing the Sail over the Yard and Stay, and booming it out with the Boat-Hook.

AX or *Axe*, the ſame with *Axis*; which ſee.

AXILLAR [of *Axilla*, *L. the Arm-pit*,] Veins, are the two Branches of the aſcending Trunk of the *Vena cava*, called *Rami ſubclavii*, which running obliquely under the *Claviculæ*, as ſoon as they are paſt them, and go up to the Arm-pits are called *Axillares*; and each of theſe parts itſelf into two Veins, the *Cephalica* and *Baſilica*.

AXILLARY *Artery*, is that Part of the *ſubclavian* Branches of the aſcending Trunk of the *Aorta*, that is got out of the *Thorax* and comes into the Arm-pits.

AXIOM, is ſuch a common, plain, ſelf-evident and received Notion, that it cannot be made more plain and evident by Demonſtration, becauſe 'tis its ſelf much better known than any thing that can be brought to prove it; as, *That Nothing can act where it is not: That a Thing cannot be and not be at the ſame time: That the Whole is greater than a Part: That where there is no Law, there is no Tranſgreſſion*, &c. A general received ground Principle or Rule in any Art or Science.

AXIS, an Axle-tree of a Cart, Waggon, *&c.*

AXIS, properly ſignifies a Line, or long Piece of Iron or Wood, paſſing through the Centre of a Sphere, which is moveable upon the ſame.

AXIS, [*Botany*,] is the ſmooth Part in the Centre of ſome Fruits, about which the other Parts are diſpoſed.

AXIS, [in *Geometry*,] is a ſtrait Line conceived to proceed from the *Vertex* or Top of a Figure to the Baſe.

AXIS, [in *Architecture*,] is otherwiſe called *Cathetus*; as,

AXIS *of the Ionick Capital*, is a Line paſſing perpendicular through the Middle of the Eye of the *Volute*.

Spiral AXIS, [*Architecture*,] is the Axis of a twiſted Column drawn ſpirally, in order to trace the Circumvolutions without.

AXIS *of a Magnet*, is a Line paſſing through the Middle of a Magnet length-wiſe, in ſuch Manner, that however the Magnet is divided, the Loadſtone will be made into two Loadſtones, if the Diviſion be according to a Plane wherein ſuch a Line is found.

AXIS, [*Anatomy*,] is the third *Vertebra* from the Skull.

AXIS *of a Cylinder*, is that quieſcent Right-line, about which the Parallelogram is turned, which by its Revolution forms the Cylinder.

AXIS *of a Conick Section*, is a Line paſſing through the Middle of the Figure, and perpendicular to the Ordinates.

AXIS *of a Circle or Sphere*, is a ſtrait Line paſſing through the Centre from one Side to another, and is the ſame with the *Diameter*.

AXIS *of the World*, is an imaginary Line conceived to paſs through the Centre of the Earth from one Pole of the Equator to another.

AXIS *of the Zodiack*, is alſo conceived to paſs through the Earth, and to be terminated in the Poles of the *Zodiack*.

AXIS *of Rotation or Circumvolution*, is an imaginary Line about which any plain Figure is conceived to be turned to make a Solid: Thus a *Sphere* is conceived to be made by the Rotation of a Semicircle about its Diameter, and a Right Cone by that of a Right-angled Triangle about its Perpendicular.

AXIS *Secundus*, in the Hyperbole and Ellipſis, is the *Conjugate Diameter*, which ſee. This is ſometimes called the *Axis rectus*.

AXIS, in *Opticks*, is the Ray which of all that are ſent to the Eye falls perpendicularly on it, and which by Conſequence paſſed through the Centre of the Eye.

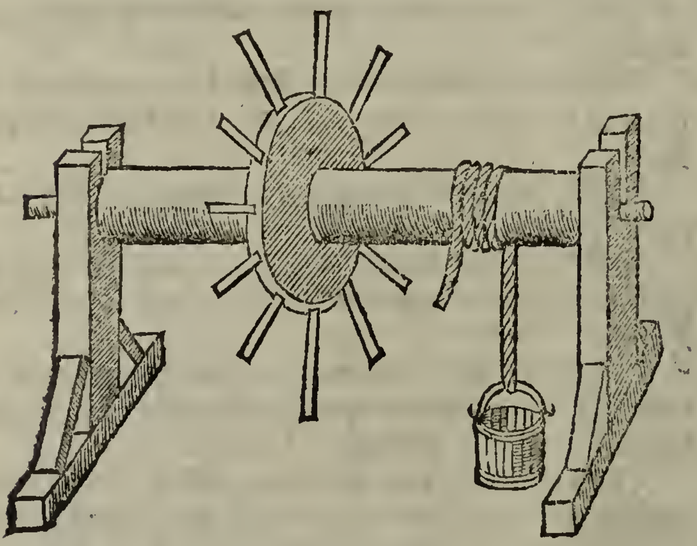
AXIS *Common or Mean*, is a Right-line drawn from the Point of Concourſe of the two Optick Nerves through the Middle of the Right-line which joins the Extremity of the ſame *Optick Nerves*.

AXIS *of Incidence*, in *Dioptricks*, is a Right-line drawn through the *Point of Incidence*, and perpendicular to the Refracting Surface.

AXIS *of Refraction*, is that which is made by the *Ray of Incidence*, directly prolonged on the Inſide of the ſecond *Medium* by the Ray of *Refraction*.

AXIS *of any Glaſs*, [in *Opticks*,] is a Right-line drawn perpendicularly through the Centre of the Glaſs; or if it be a *Convex* Glaſs, through the thickeſt Part; if a *Concave*, through the thinneſt Part (which in each is called the *Pole of the Glaſs*) directly on to the Centre of the Sphere, the Glaſs Figure is a Segment of.

AXIS *in Peritrochio*, is a Machine for the raiſing of Weights, conſiſting of a Cylindrical Beam (which is the *Axis*) lying horizontally, and ſupported at each End by a Piece of Timber; and ſomewhere about it, it hath a kind of *Tympanum* or Wheel, which is called the *Peritrochium*, in whoſe Circumference are Holes made to put in Staves (like thoſe of a Windleſs or Capſtern) in order to turn the *Axis* round the more eaſily, and thereby to raiſe the Weight required by Means of a Rope which winds round the *Axis*.



AXIS *Indeterminate of an Hyperbola*, is a Right-line which divides into two equal Parts, and at Right-angles, an infinite Number of Lines drawn parallel to one another within the *Hyperbola*.

AXIS *Determinate*, in that Figure, is a Right-line drawn between the *Vertices* or Tops of the oppoſite Sections or *Hyperbola*.

AXIS *Conjugatus*; in the *Hyperbola*: See *Conjugate*.

AYDE, [in *Law*,] is where a particular Proprietor is impleaded, and not being able to defend the Thing for which he is ſo impleaded, he *prayeth Ayde* of ſome better able; which is done two Ways, 1. In a *Plea real*, and *tenens petit auxilium de* A. B. *ſine quo reſpondere non poteſt*. 2. In a *Plea perſonal*, and then the Defendant *petit auxilium ad manutenendum Exitum*.

AYEL, is a Writ which lies where the Grandfather (called by our common Lawyers *Beſayel*, it ſhould be *Beſayeul*) was ſeized in his Demeſne, as of Fee of any Lands and Tenements in Fee ſimple, the Day that he died, and a Stranger abateth and entereth the ſame Day, and diſpoſſeſſeth the Heir.

AYZAMENTA, *Eaſements*, in Grants of Conveyance and Demiſe, did include any Liberty of Paſſage, High-way, Water-courſe, or other cuſtomary Benefit for the Eaſe and Accommodation of the Owners or Inhabitants of any Houſe, or the Tenants of any Land. *Kennet*'s *Gloſſary*.

AZIMEN *Degrees*, [*Aſtrology*,] i. e. *lame or weak*. Certain Degrees of the *Zodiack*, ſo termed, becauſe they pretend that Perſons born, when any of them aſcend, are commonly afflicted with Blindneſs, Lameneſs, or ſome other natural Imperfection.

AZIMUTH *of the Sun*, is an Arch of the Horizon comprehended between the Meridian of the Place, and any given Vertical, and may be found by this Propoſition.

As the Co-ſine of the Sun's Altitude, is to the Sine of the Time from Noon; ſo is the Co-ſine of the Sun's Declination, to the Sine of the Sun's Azimuth from the *North*, at any Time of the Day.

AZIMUTH, is an Arch of the Horizon comprehended between the Meridian of the Place, and any other *Azimuth Circle*; or contained between the Prime Vertical, and any other *Azimuth Circle*.

To find the *Azimuth* at any Time: See the 11th Caſe of *Oblique Angled Spherical Triangles*, under the Word *Trigonometry*.

To find the Sun's *Azimuth*, as alſo the *Hour*, by the Globe, having the Sun's Place and Altitude given.

Rectify your Globe, and fit the Quadrant; then turn both Globe and Quadrant about till the Sun's Place cut the given Altitude in the Quadrant; for then the Index ſhews the Hour, and the Quadrant the *Azimuth* in the Horizon.

To find the Sun's *Azimuth* at Six, having the Latitude of the Place, and the Sun's Declination given.

Say, As the Co-ſine of the Latitude: Is to the Radius:: So is the Co-Tangent of the Sun's Declination: To the Tangent of the Sun's *Azimuth* at Six.

Example. Let the Latitude be 51 *Deg.* 30 *Min.* and the Sun's Declination be 11° 30′.

Then

$\left.\begin{array}{l}\text{Then to the Ar. co of}\\ \quad\text{the Co-Sine of}\end{array}\right\}$ 51°. 30′. — 0,205850
Add the Co-Tangent of 12°. 31′. — 10,690891

Sum is the Tangent of 83°. 50′ = 10,896741
which is the *Azimuth* at Six required.

To find the Time when the Sun will be exactly on the Eaſt or Weſt *Azimuth*, having the Sun's Declination and Latitude of the Place given.

Say, As the Co-Tangent of the Declination : Is to the Co-Tangent of the Latitude :: So is Radius : To the Sine of an Ark ; which converted into Time, ſhews the Hour from Six.

Example. Suppoſe the Declination be 11°. 31′.
The Latitude of the Place 51. 30.
$\left.\begin{array}{l}\text{Then to the Ar. co of}\\ \quad\text{the Co-Tangent of}\end{array}\right\}$ 11°. 31′. — 9,309180
Add the Co-Tangent of 51°. 30′. — 9,900605

Sum is the Sine of 09°. 12′. = 19,209713
which is 48 Minutes of an Hour.

Therefore the Sun will be due *Eaſt* in the Morning 12 Minutes before Seven, and *Weſt* in the Evening 12 Minutes after Five.

To find the *Azimuth*, having given the Latitude of the Place, the Sun's Altitude at Six, and preſent Altitude.

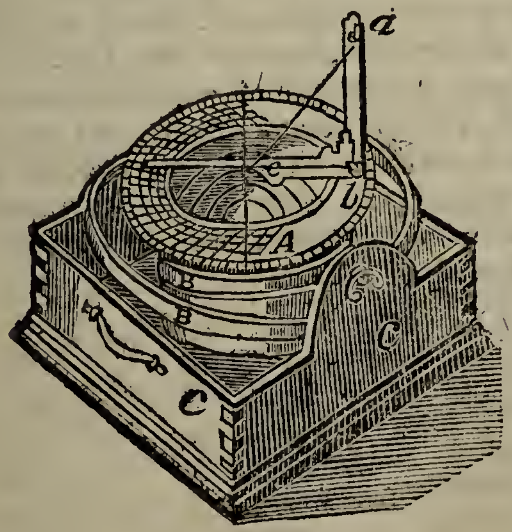
In Summer.

Say, As the Co-ſine of the Altitude : Is to the Tangent of the Latitude :: So is the Difference between the Sines of the Sun's Altitude at Six, and preſent Altitude : To the Sine of the Azimuth from Eaſt to Weſt.

In Winter.

Say, As the Co-ſine of the Altitude : Is to the Tangent of the Latitude :: So is the Sum of the Sines of the Sun's Altitude at Six, and preſent Altitude : To the Sine of the *Azimuth* from Eaſt or Weſt.

AZIMUTH *Compaſs*, is ſomething different from the common Sea Compaſs ; for upon the round Box, wherein is the Card, is faſtened a broad braſs Circle *c b*, one Semi-circle whereof is divided into 90 equal Parts or Degrees, numbred from the Middle of the ſaid Diviſions both Ways, with 10, 20, *&c.* to 45 Degrees ; which Degrees are alſo divided into Minutes by Diagonal Lines and Circles : But theſe graduating Lines are drawn from the oppoſite Part of the Circle, *viz.* from the Point *b*, wherein the Index turns in Time of Obſervation.



b a is that Index moveable about the Point *b*; and moves with a Hinge, that ſo it may be raiſed or laid down, according to Neceſſity. From the upper Part of this Sight, down to the Middle of the Index, is faſtened a fine Hypothenuſal Luteſtring or Thread *a e*, to give a Shadow upon a Line that is in the Middle of the ſaid Index.

Note, The Reaſon of making the Index move on a Pin faſtened at *b*, is, that the Degrees and Diviſions may be larger ; for now they are as large again as they would have been, if they had been divided from the Centre, and the Index made to move thereon.

The above-mentioned broad Circle *a b*, is croſſed at Right-angles with two Threads, and from the Ends of theſe two Threads are drawn four ſmall black Lines on the Inſide of the round Box ; alſo there are four Right-lines drawn at Right-angles to each other on the Card.

This round Box, thus fitted with its Card, graduated Circle, and Index, *&c.* is to be hung in braſs Hoops *B B* ; and theſe Hoops are faſtened to the great ſquare wooden Box *C C.*

The Uſe of the Azimuth Compaſs in finding the Sun's magnetical Azimuth or Amplitude ; and from thence the Variation of the Compaſs.

There are ſeveral Ways of finding the Variation of the Needle, as by riſing and ſetting of the ſame Star ; or by the Obſervation of the two equal Altitudes of a Star above the Horizon, ſince the ſaid Star, at each of thoſe times will be equally diſtant from the true Meridian of the World ; or elſe by a Star's Paſſage over the Meridian.

But theſe Methods are not much uſed at Sea ; firſt, becauſe the Time wherein the Sun, or a Star, paſſes over the Meridian, cannot be known preciſely enough ; for there is a great deal of Time taken in making Obſervations of the Sun's Altitudes, till he is found to have the greateſt ; that is, his Meridian Altitude.

Secondly, Becauſe the Sun's Declination may be conſiderably altered, and alſo the Ship's Latitude between the Times of the two Obſervations of his equal Altitudes above the Horizon Morning and Evening, or of his riſing and ſetting.

Therefore, the Variation of the Compaſs may much better be found by one Obſervation of the Sun's magnetical Amplitude, or Azimuth. But the Sun's Declination, and the Latitude of the Place the Ship is in, muſt be known, that ſo his true Amplitude may be had ; his Altitude muſt alſo be given, when the magnetick Azimuth is taken, that ſo his true Azimuth may be had at that Time alſo. Now if the Obſervation be for an Amplitude at Sun-riſing, or an Azimuth before Noon, you muſt put the Centre of the Index *b c* upon the Weſt Point of the Card within the Box, that they may agree or come together ; but if the Obſervation be for the Sun's Amplitude, ſetting, or an Azimuth in the Afternoon, then you muſt turn the Centre of the Index right againſt the Eaſt Point of the Card, and make the Lines within the Box concur with thoſe on the Card. Having thus fitted the Inſtrument for Obſervation, turn the Index *b e* towards the Sun, till the Shadow of the Thread *d e* falls directly upon the Slit of the Sight, and upon the Line that is along the Middle of the Index ; then will the inner Edge of the Index cut the Degree and Minute of the Sun's magnetical Azimuth from the North or South.

But *note*, that if the Compaſs being thus plac'd, the Azimuth be leſs than 45 *deg.* from the South, and the Index be turned towards the Sun, it will then paſs off the Diviſions of the Limb, and ſo they become uſeleſs as it now ſtands; therefore you muſt turn the Inſtrument juſt a Quarter of the Compaſs, that is, place the Centre of the Index or the North or South Point of the Card, according as the Sun is from you, and then the Edge thereof will cut the Degree of the magnetick Azimuth, or Sun's Azimuth from the North, as before.

The Sun's magnetical Amplitude, (that is, the Diſtance from the Eaſt or Weſt Points of the Compaſs, to that Point in the Horizon whereat the Sun riſes or ſets) being obſerved by this Inſtrument, the Variation of the Compaſs may be thus found.

Example. Being out at Sea the 15th Day of *May*, in the Year 1715, in 45 *deg. North Lat.* I find from Tables, that the Sun's Declination is 19 *deg. North*, and his *Eaſt* Amplitude 27 *deg.* 25 *min. North*; now I obſerve by the Azimuth Compaſs, the Sun's magnetical Amplitude at his riſing and ſetting; and find, that he riſes between the 62d and 63d *deg.* reckoning from the North towards the Eaſt Part of the Compaſs, that is, between the 27th and 28th *deg.* from the Eaſt; and ſince in this Caſe the magnetical Amplitude is equal to the true Amplitude, I conclude, that at this Place and Time the Needle has no Variation.

But if the Sun at his Riſing ſhould have appeared between 52 and 53 *deg.* from the North towards the Eaſt, his magnetical Amplitude would then be between 37 and 38 *deg.* that is, about 10 *deg.* greater than the true Amplitude; and therefore the Needle would vary about 10 *deg.* North-Eaſterly. If, on the contrary, the magnetical Eaſt Amplitude found by the Inſtrument ſhould be leſs than the true Amplitude, their Difference would ſhew, that the Variation of the Needle is North Eaſterly. For if the magnetical Amplitude be greater than the true Amplitude, this proceeds from hence, that the Eaſt Part of the Compaſs is drawn back from the Sun towards the South, and the *Flower-de-luce* of the Card approaches to the Eaſt, and ſo gives the Variation North-Eaſterly. The Reaſon for the contrary of this is equally evident.

If the true Eaſt Amplitude be Southwardly, as likewiſe the magnetical Amplitude and this laſt be the greater, then the Variation of the Needle will be North-Weſt; and if on the contrary, the magnetical Amplitude be leſs than the true Amplitude, the Variation of the Needle will be North-Eaſterly, as many Degrees as are contained in their Difference.

What we have ſaid concerning North-Eaſt Amplitudes, muſt be underſtood of South-Weſt Amplitudes; and what we have ſaid of South-Eaſt Amplitudes, muſt be underſtood of North-Weſt Amplitudes.

Finally, If Amplitudes are found of different Denominations; for Example, when Amplitudes are Eaſt, if the true Amplitude be 6 *deg.* North, and the magnetical Amplitude 5 *deg.* South, then the Variation, which in this Caſe is North-Weſt, will be greater than the true Amplitude, it being equal to the Sum of the magnetical and true Amplitudes; and ſo adding them together, we ſhall have 11 *deg.* of North-Weſt Variation. Underſtand the ſame for Weſt Amplitudes.

The Variation of the Compaſs may likewiſe be found by the Azimuth; but then the Sun's Declination, the Latitude of the Place, and his Altitude, muſt be had, that ſo his true Azimuth may be found.

AZIMUTH *Magnetical*: See *Magnetical Azimuth*.

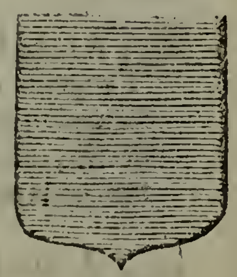
AZIMUTHS, or *Vertical Circles*, are great Circles interſecting each other in the *Zenith* and *Nadir*, (as Meridians or Hour-Circles do in the Pole) and cutting the Horizon at Right-angles.

On the Globes theſe Circles are not drawn, but are repreſented by the *Quadrant of Altitude* when it is ſcrewed in the *Zenith*.

And on theſe Azimuths is reckoned the Sun's Altitude, when he is not on the Meridian.

AZOTH, (among the *Chymiſts*) ſignifies ſometimes an univerſal Medicine, ſometimes the Mercury of a Metal.

AZURE, [in *Heraldry*,] a Term for a blue Colour in the Coats of all Perſons under the Degree of a Baron; but in the Eſcutcheons of the Noblemen 'tis called *Saphir*; and in thoſe of Sovereign Princes 'tis called *Jupiter*. In Engraving it is repreſented by Strokes or Hatches drawn only horizontally, thus, as in the annexed Figure.



AZUGOS or AZYGOS, [Ἄζυγος,] is a notable Branch of the *Vena cava*, called *Vena ſine pari*, becauſe it is ſingle, having no Fellow. It deſcends through the Right Side of the Cavity of the *Thorax*, and when it is come as far as the 8th or 9th *Vertebra*, it begins juſt to keep the Middle, and ſends forth on each Side intercoſtal Branches to the Interſtices of the eight loweſt Ribs, and there is divided into two Branches, of which the larger deſcends to the Left, betwixt the Proceſſes of the Diaphragm, and is inſerted ſometimes into the *Cava* above or below the Emulgent, but oftner into the Emulgent itſelf. The other, which goes down on the Right-hand, enters the *Cava*, commonly a little above the Emulgent, but very ſeldom is joined to the Emulgent itſelf.

BACCIFEROUS *Plants*, [*Baccifer*, *L. bearing Berries*,] whether Trees, Shrubs, or Herbs, are ſuch as bear Berries; and Berries are Fruits covered with a thin Membrane, in which is contained a Pulp, which grows ſoft and moiſt when ripe, and contains the Seed within the Subſtance. The *Bacciferous Herbs* are the *Chamæmorus*, *Smilax aſpera*, *Bryonia alba* and *nigra*, *Angelica baccifera*, *Aconitum Racemoſum*, *Solanum Racemoſum Americanum*, *Hypogloſſum*, *Laurus Alexandrina*, *Oxymyrſine*, *Polygonatum*, *Lilium Convallium*, *Monophyllon*, *Mandragora*, *Herba Paris*, *Solanum Lethale*, *Malum Inſanum*, *Solanum Vulgare*, *Alſine Baccifera*, *Solanum Somniferum*, *Alkekengi*, *Aſparagus*, *Vitis Idæi paltuſtris*, &c.

The *Bacciferous Trees*, Mr. *Ray* divides into four Kinds.

1. Such as bear a calculate or naked Berry, the Flower and Calix both falling off together, and leaving the Berry bare, as the *Saſſafras Tree*, &c.

2. Such as have a naked, *monopyrenous* Fruit, *i. e.* containing in it only one Seed; as the *Arbutus Terebinthus*, *Lentiſcus*, *Viſcus*, *Phyllcræa*, *Sambucus*, *Aquaticus*, *Laureola*, *Chamælæa Germanica* (or *Mezereon*) *Viburnum*, *Cornus*, *Rhamnus*, &c.

3. Such as have alſo a naked but *polypyrenous* Fruit; *i. e.* one containing two or more Kernels or Seeds within it; as the *Jaſamiuum*, *Liguſtrum*, *Alnus*, *Berberis*, *Alaternus*, *Sambucus vulgaris*, *Vitis*, the *Tea Plant*, *Euonymus vulgaris*, *Agrifolium*, *Rhamnus catharticus*, *Capparis*, *Erica Baccifera*, &c.

4. Such as have their Fruit compoſed of many *Acini* or round ſoft Balls (for the Word *Acinus*, in Botany, is rather a *Grape* than a *Grape-ſtone*) ſet cloſe together like a Bunch of Grapes; as the *Uva Marina*, *Rubus vulgaris*, *Rubus Idæus*, and the *Rubus minor fructu cæruleo*.

BACCIVOROUS [*baccivorus*, *L. devouring Berries*] *Creatures*, are ſuch Animals as feed upon Berries.

BACBERIND *Thief*, (a Term in *Law*,) ſignifying a Thief taken with the Manner (as they ſay) *i. e.* having on his Back or about him, thoſe things he hath ſtollen. It is by ſome taken for an Offender againſt Vert or Veniſon in the Foreſt.

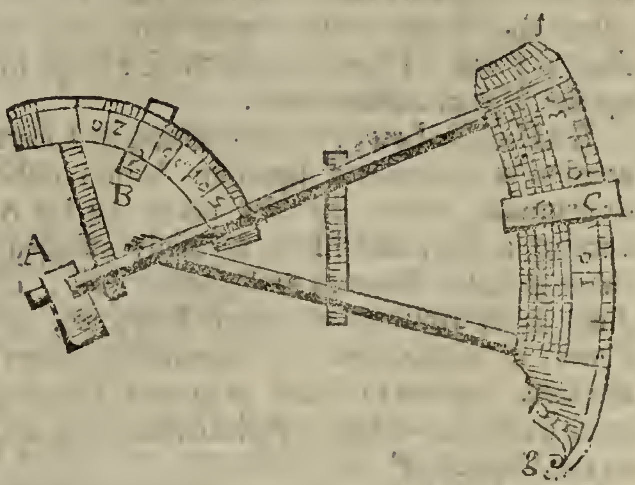
BACCHIUS, is a Foot of a Latin Verſe, conſiſting of three Syllables, where the firſt is ſhort, and the two laſt long, as *Egeſtas*: This is the Reverſe of a *Dactyl*. *L.*

BACILLI, are thoſe Medicines which are of a long round Figure, like a Stick, *&c.*

BACK STAYS *of a Ship*; ſee *Stays.*

BACK-STAFF, the ſame with *Davis*'s Quadrant, or the *Engliſh* Quadrant, as it is called by the *French*. 'Twas invented by one Captain *Davis*, a *Welſhman*; and is a Sea Inſtrument of good Uſe to take the Sun's Altitude at Sea. It conſiſts of three Vanes, *A*, *B*, and *C*; and of two Arches.

The Vane at *A* is called the *Horizon Vane*, that at *B* the *Shade Vane*, and that at *C* the *Sight Vane*. The leſſer Ark *B* is of 60 Degrees, and that of *C* (or *fg*) of 30 Degrees. In Time of Obſervation, the Shadow Vane *B* is ſet upon the 60th Arch juſt to an even Degree of ſome Altitude, leſs than you judge the Complement of the Sun's Altitude will be, by 10 or 15 Degrees. The Horizon Vane is put on at *A*, and the Sight Vane on the 30th Ark



fg; and then the Obſerver's Back being turned to the Sun (whence the Name of *Back-Staff* or *Back-Quadrant*) he lifts up the Inſtrument, and looks through the Sight-Vane, riſing or falling the Quadrant, till the Shadow of the upper Edge of the *Shade Vane* fall on the upper Edge of the Slit in the *Horizon Vane*; and if then you can ſee the Horizon through the ſaid Slit, the Obſervation is well made: But if the Sea appear inſtead of the Horizon, move the *Sight-Vane* lower towards *g*; if the Sky appear, move it upwards towards *f*; and ſo try it till it comes right.

Then obſerve how many Degrees and Minutes are cut by that Edge of the *Sight Vane*, which anſwers to the *Sight-Hole*, and to them add the Degrees cut by the upper Edge of the *Shade Vane*: the Sum is the Sun's Diſtance from the Zenith, or the Complement of his Altitude.

To find the Meridian Altitude by this Inſtrument, you muſt continue the Obſervation as long as you perceive the Altitude to be increaſing; which you will find by the Sea's appearing ſtill through the Slit inſtead of the Horizon, and as you move the *Sight Vane* lower: But as ſoon as ever you ſee the Sky appear inſtead of the Horizon, the Altitude is then diminiſhing, and you muſt deſiſt; and adding (as before) the Degree and Minutes on the two Arks together into one Sum, it gives the Sun's Zenith Diſtance, or his Co-altitude; and this ſubſtracted from 90°. leaves the true Altitude above the Horizon.

That excellent Aſtronomer Mr. *Flamſtead*, contrived a Glaſs Lens or double Convex to be placed in the Middle of the *Shade Vane*, which makes a ſmall bright Spot on the Slit of the *Horizon Vane*, inſtead of the Shade: And this is a great Improvement, if the Glaſs be truly made; for by this Means the Inſtrument may be uſed in hazy Weather, and a much more accurate Obſervation made in clear Weather, than could be by the Shadow.

But after all, this Quadrant is by no Means ſo accurate as could be wiſhed; and a large heavy Braſs Aſtrolabe muſt needs be a much better Inſtrument.

BACULE, [in *Fortification*,] is a kind of Portcullice or Gate made like a Pit-fall with a Counterpoiſe, and ſupported by two Stakes. 'Tis uſually made before the *Corps de Gards* advanced near the Gates. *F.*

BACULOMETRY, [of *Baculus*, *L.* of βάκτρον, *a Staff*, and μέτρον, *Gr. Meaſure*,] according to ſome, is the Art of meaſuring acceſſible and inacceſſible Heights, by the Help of one or more Staves.

BADGER, [of *Bagagier*, *F.*] in *Law*, is one that is licenſed to buy Corn or other Victuals in one Place, and carry it to another.

BAIL or *Bale*; the Seamen call lading or caſting the Water by Hand out of a Boat *Bailing*; and when the Water is thus bailed out, they ſay, the *Boat is freed.* They call alſo thoſe Hoops that bear up the Tilt of a Boat *Bails.*

BAIL, [in *Law*,] is the ſetting at Liberty one arreſted or impriſoned upon an Action either civil or criminal, under Sureties taken for his Appearance at a Day and Place certainly aſſigned: And there is both *Common* and *ſpecial Bail*; *Common Bail* is in Actions of ſmall Prejudice, or ſlight Proof, in which Caſe any Sureties are taken; *Special Bail*, is given in Caſes of greater Weight, who muſt be Subſidy-Men at the leaſt, and they according to the Value. *F.*

BAILMENT, [a Term in *Law*,] ſignifying the Delivery of Things, whether Writings or Goods, to another, ſometimes to be delivered back to the Bailor, that is, to him that ſo delivers them, ſometimes to the Uſe of him to whom they are deliver'd, and ſometimes to a third Perſon.

BAILIFF, is an Officer that belongs to a Manor, to order the Husbandry, and hath Authority to pay Quit-rents iſſuing out of the Manor, fell Trees, repair Houſes, &c. This Officer is he whom the ancient *Saxons* called a *Reeve.*

BAILIFF *Errant*, is one that the Sheriff makes and appoints to go about the Country to execute Writs, to ſummon the Country Seſſions, Aſſizes, &c.

BAILIFFS *of Franchiſes*, are thoſe which are appointed by every Lord within his Liberty, to do ſuch Offices within his Precincts, as the *Bailiff Errant* doth abroad in the Country.

BAILIWICK, is the Juriſdiction of a Bailiff within his Lord's Franchiſe.

BAKER's *Central Rule* for conſtructing Equations: See *Conſtruction of Equations.*

BALANCE, *Libra*, or the *Scales*, one of the ſix ſimple Powers in *Mechanicks*, uſed principally for determining the Equality or Difference of Weights in heavy Bodies, and conſequently their Maſſes or Quantities of Matter. The Balance is of two Kinds, *viz.* *Ancient* and *Modern*; the *ancient* or *Roman*, called the *Statera Romana*, or *Steel-yard*, conſiſts of a Lever or Beam, moveable on a Centre, and ſuſpended near one of its Extreams; on one Side the Centre are applied the Bodies to be weighed, and their Weight; meaſured by the Diviſions marked on the Beam, in the Place where a Weight moveable along the Beam being fixed, keeps the Balance in *Equilibrio.* This is ſtill in Uſe in Markets, &c. where large Bodies are to be weigh'd.

The modern *Balance*, now ordinarily in Uſe, conſiſts of a Lever, or Beam ſuſpended exactly by the Middle, to the Extremes whereof are hung Scales; in each Caſe the Beam is called the *Brachia*; the Line on which the Beam turns, or which divides its *Brachia*, is called the *Axis*, and when conſidered with Regard to the Length of the *Brachia*, is but eſteemed a Point, and called the *Centre of the Balance*, and the Places where the Weights are applied, the *Points of Suſpenſion* or *Application*, in the *Roman Balance*; therefore the Weight uſed for a Counter-balance is the ſame, but the Points of Application various; in the Common Balance the Counterpoiſe is various, and the Points of Application the ſame, the Principal on which each is founded is the ſame, and may be conceived from what follows.

The *Axis* of a Balance, is that Line about which the Balance moves, or rather turns round.

When we conſider the Length of the *Brachia*, or of the Beam, then the *Axis* is to be look'd upon as a Point, and called the *Centre of the Balance.*

We call Points of *Suſpenſion* or *Application*, thoſe Points where the Weights really are, or from which they hang freely; or the Scales in which the Weights are placed.

Concerning this Machine, we are to obſerve,

That the Weight does equally preſs the Point of Suſpenſion, at whatever Height it hangs from it; and in the ſame Manner as if it was fixed at that very Point.

For the Weight at all Heights equally ſtretches the Rope by which it hangs; this is alſo proved by

Experiment 1. In the Balance *A B*, the Weight *P* by Means of the Rope *B D* (*Plate* 2. *Fig.* 14.) is ſuſpended at different Heights; and the Poſition of the Balance is not changed by it.

The Action of a Weight to move a Balance, is by ſo much greater, as the Point preſſed by the Weight is more diſtant from the Centre of the Balance; and that Action follows the Proportion of the Diſtance of the ſaid Point from that Centre.

When the Balance moves about its Centre, the Point *B* deſcribes the Arc *B b*, (*Plate* 2. *Fig.* 15.) whilſt the Point *A* deſcribes the Arc *A a*, which is the biggeſt of the two; therefore in that Motion of the Balance, the Action of the ſame Weight is different, according to the Point to which it is applied, and it follows the Proportion of the Space gone thro' by that Point; at *A* therefore it is as *A a*, and at *B* as *B b*; but thoſe Arcs are to one another as *C A* to *C B.*

Experiment 2. The *Brachia* of the Balance *A B* (*Plate* 2. *Fig.* 16.) are divided into equal Parts; and one Ounce applied to the 9th Diviſion from the Centre, is as powerful as three Ounces at the third; and two Ounces at the ſixth Diviſion act as ſtrongly as three at the fourth.

The Conſtruction of a Balance for this and ſome other following Experiments, is plain enough from the Figure; hence it follows, that the Action of a Power to move a Balance, is in a Ratio compounded of the Power itſelf, and its Diſtance from the Centre; for that Diſtance is as the Space gone through in the Motion of the Balance.

A Balance is ſaid to be in *Equilibrio*, when the Actions of the Weights upon each *Brachium* to move the Balance are equal, ſo that they mutually deſtroy each other, as appears by the foregoing Experiment.

When a Balance is in *Equilibrio*, the Weights on each Side are ſaid to equiponderate.

Unequal Weights can equiponderate; for this it is requiſite, that the Diſtances from the Centre be reciprocally as the Weights in that Caſe, if each Weight be multiplied by its Diſtance, the Products will be equal.

Experiment 3. In the above-mentioned Balance (*Plate* 2. *Fig.* 16.) one Ounce at the Diſtance of the ninth Diviſion from the Centre, equiponderates with three Ounces at the third Diviſion.

The *Steel-yard*, or *Statera Romana*, which weighs any thing with one Weight, is made upon this Principle.

Experiment 4. The *Steel-yard* A B (*Plate* 2. *Fig.* 17.) has two *Brachia* very unequal; a Scale hangs at the ſhorteſt; the longeſt is divided into unequal Parts; apply ſuch a Weight to it, that at the firſt Diviſion it ſhall equiponderate with one Ounce laid in the Scale; then the Body to be weighed is put into the Scale, and the above-mentioned Weight is to be moved along the longeſt *Brachium*, till you find the *Equilibrium*; the Number of Diviſions between the Body and the Centre, ſhews the Number of Ounces that the Body weighs, and the Subdiviſions the Parts of an Ounce.

Upon this Principle alſo is founded the deceitful Balance, which cheats by the Inequality of the *Brachia*.

Experiment 5. Take two Scales of unequal Weights, in the Proportion of 9 to 10 (*Plate* 2. *Fig.* 1.) and hang one of them at the tenth Diviſion of the Balance above deſcribed, and the other at the ninth Diviſion, ſo that there may be an *Equilibrium*; if then you take any Weights; which are to one another as 9 to 10, and put the firſt in the firſt Scale, and the other in the other, they will equiponderate.

Several Weights hanging at ſeveral Diſtances on one Side, may equiponderate with a ſingle Weight on the other Side: To do this, it is required, that the Product of that Weight, by its Diſtance from the Centre, be equal to the Sum of the Products of all the other Weights, each being multiplied by its Diſtance from the Centre.

Experiment 6. Hang three Weights of an Ounce each, at the ſecond, third, and fifth Diviſions from the Centre, and they will equiponderate with the Weight of one ſingle Ounce applied at the tenth Diviſion of the other *Brachium*, (*Plate* 2. *Fig.* 18.) and the Weight of one Ounce at the ſixth Diviſion, and another of three Ounces at the fourth Diviſion, will equiponderate with a Weight of two Ounces on the other Side at the ninth Diviſion.

Several Weights, unequal in Number, on either Side, may equiponderate in that Caſe, if each of them be multiplied by its Diſtance from the Centre; the Sums of the Products on either Side will be equal; and if thoſe Sums are equal, there will be an *Equilibrium*.

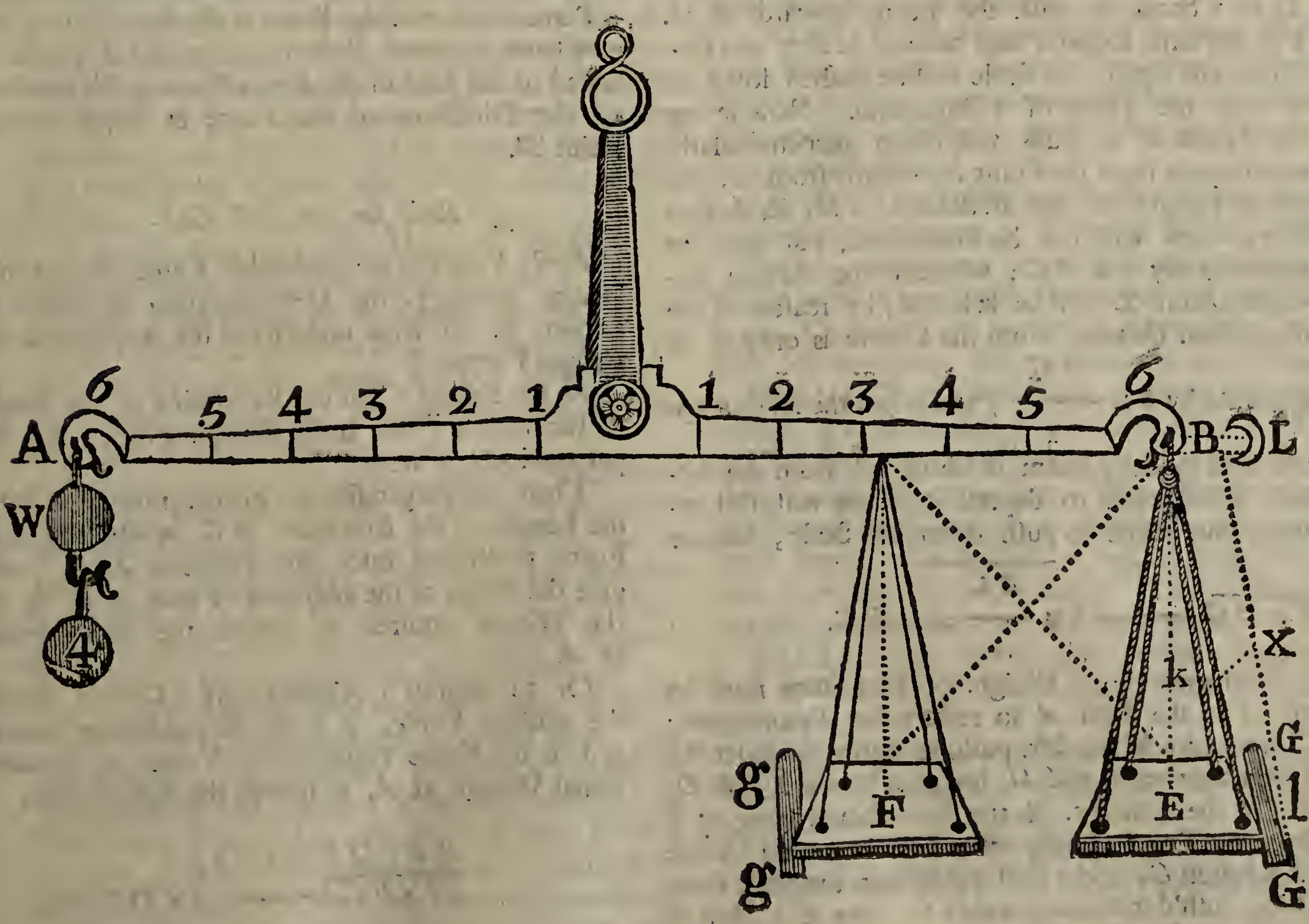
Experiment 7. Hang on a Weight of two Oun(ces *Plate* 2. *Fig.* 19.) at the fifth Diviſion, and two others, each of one Ounce, at the ſecond and ſeventh, and on the other Side hang two Weights, each alſo of one Ounce, at the ninth and tenth Diviſions; and theſe two will equiponderate with thoſe three.

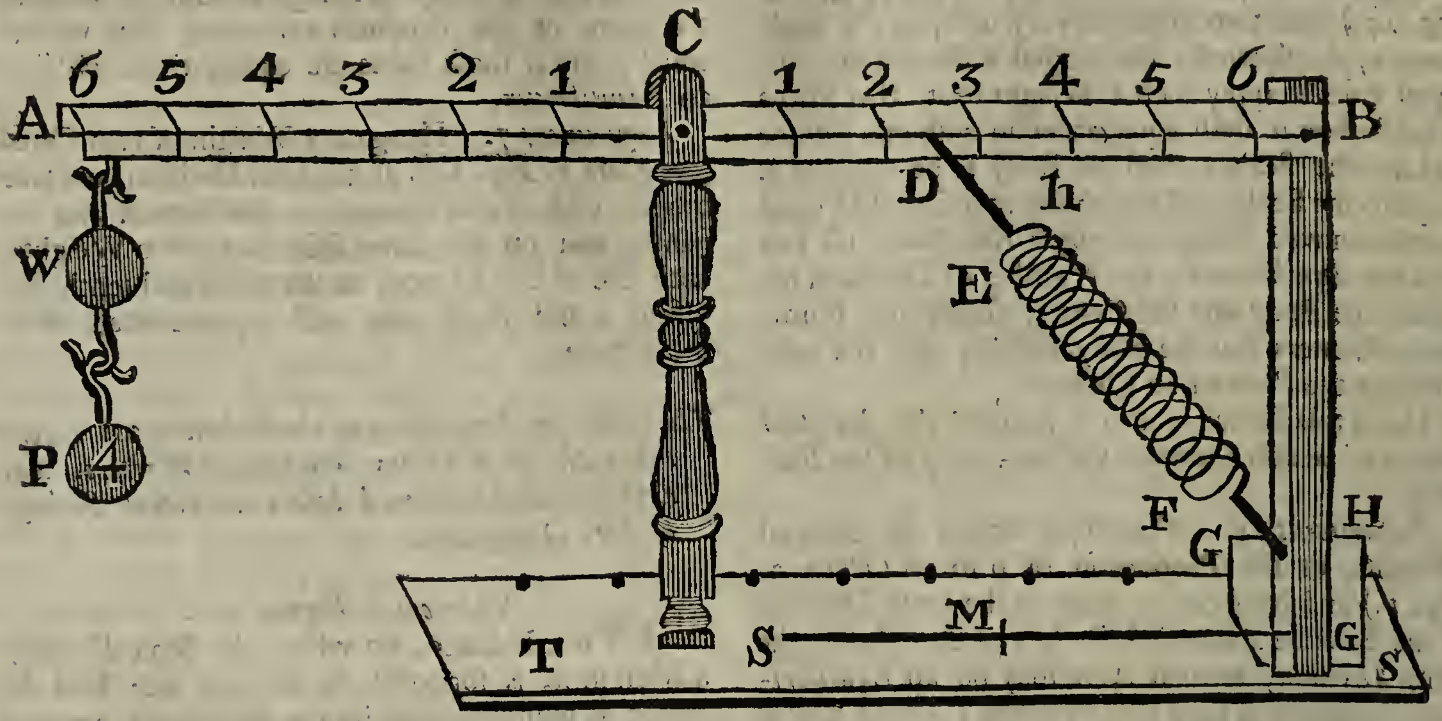
The following Propoſition on the Balance, not before taken Notice of by any Mechanical Writers, was explained and confirmed before the Royal Society, by Dr. Deſaguliers.

Theorem. Figure 1.

A B is a Balance, on which the Scale *E*, with a Man in it, is ſuppoſed to hang at one End *B*, which is counterpoiſed by the Weight *W* hanging at the other End of the Balance *A*. If the Man in the Scale puſhes with a Cane, or other ſtiff Body, upwards againſt the Beam any where between the Points *C* and *B*, (provided he puſhes not directly againſt *B*) he will by that Means make himſelf heavier, or overpoiſe the Weight *W*, though the Stop *G C* hinders the Scale *E* from being thruſt outwards fromwards *D*: The Man alſo by puſhing upwards againſt *B*, or any where between *B* and *D*, (provided he does not puſh directly againſt *D*) will make himſelf lighter, or be overpoiſed by the Weight *W*, which before did but juſt counterpoiſe the Weight of his Body and the Scale.

If the common Centre of Gravity of the Scale *E*, and the Man who is diſpoſed to ſtand in it be at *k*, and the Man, by thruſting againſt any Part of the Beam cauſe the Scale to move outwards, ſo as to carry the ſaid common Centre of Gravity to *k x*, then inſtead of *B E*, *L l* will become the Line of Direction of the compound Weight, the Action of which will be increaſed in the Ratio of *L C* to *B C*. This is what ſeveral Writers of *Mechanicks*





have explained; but the Caſe, when the Scale is kept from flying out, as it is here by the Poſt *g g*, which keeps it in its Place, as if the Strings of the Scale were become inflexible, has not been conſidered by any one.

Now to explain this Caſe, Let the Length *B D* of half of the *Brachium B C*, be ſuppoſed to be equal to three Feet, the Line *B E* to four Feet, the Line *E D* of five Feet to be the Direction in which the Man puſhes *D F* and *F E*, to be reſpectively equal and parallel to *B E* and *B D*, and the whole or abſolute Force with which the Man puſhes equal to (or able to raiſe) ten Stone; let the oblique Force *E D* (= 10 Stone) be reſolved into the two *E F* and *E B*, (or its Equal *F D*) whoſe Directions are at Right-angles to each other, and the reſpective Quantities (or Intenſities) of which are as 6 and 8, becauſe *E F* and *B E* are in that Proportion to each other, and to *E D*. Now *E F* being parallel to *B D C A*, the Beam, it does no way affect the Beam to move it upwards; and therefore there is only the Force repreſented by *E D* or 8 Stone to puſh the Beam upwards at *D*. For the ſame Reaſon, and becauſe Action and Reaction are equal, the Scale will be puſhed down at *E* with the Force of 8 Stone alſo. Now ſeeing the Force at *E* pulls the Beam perpendicularly downwards from the Point *B*, diſtant from *C*, the whole Length of the *Brachium B D*, its Action downwards will not be diminiſhed, but may be expreſſed by $8 \times BC$; whereas the Action upwards againſt *D* will be half loſt, by reaſon of the diminiſhed Diſtance from the Centre is only to be expreſs'd by $8 \times \frac{BC}{2}$; and when the Action upwards to raiſe the Beam is ſubtracted from the Action downwards to depreſs it, there will ſtill remain four Stone to puſh down the Scale; becauſe

$$\overline{8 \times BC} - \overline{8 \times \frac{BC}{2}} = 4\,BC.$$

Conſequently, a Weight of four Stone muſt be added at the End *A* to reſtore the *Equilibrium*: Therefore a Man, *&c.* puſhing upwards under the Beam between *B* and *D*, becomes heavier. *Q.E.D.*

On the contrary, if the Scale ſhould hang at *F* from the Point *D* only three Feet from the Centre of Motion *C*, and a Poſt *g g* hinders the Scale from being puſh'd inwards towards *C*, then if a Man in this Scale *F* puſhes obliquely againſt *B* with the oblique Force above-mentioned; for the Reaſons before given (in reſolving the oblique Force into two others acting in Lines perpendicular to each other) the whole Force will be reduced to 8 Stone, which puſhes the Beam directly upwards at *B*, while the ſame Force of 8 Stone draws it directly down at *D* towards *F*. But as *C D* is only equal to half of *C B*, the Force of *D* compar'd with that of *B*, loſes half its Action; and therefore can only take off the Force of four Stone from the Puſh upwards at *B*, and of Conſequence the Weight *W* at *A* will preponderate, unleſs an additional Weight of four Stone be hanging at *B*. *Therefore a Man*, &c. *puſhing upwards under the Beam between* B *and* D, *becomes lighter*. Q. E. D.

S C H O L I U M I.

Hence knowing the abſolute Force of a Man that puſhes upwards, (that is, the whole oblique Force) the Place of the Point of Truſion *D*, and the Angle made by the Direction of the Force with a Perpendicular to the Beam at the ſame Point, we may have a general Rule to know what Force is added to the End of the Beam *B* in any Inclination of the Direction of the Force or Place of the Point *D*.

Rule for the Firſt Caſe.

Firſt, Find the perpendicular Force by the following Analogy, the Demonſtration of which is known to all who underſtand the Application of oblique Forces.

As the Radius : To the Right Sine of the Angle of Inclination :: So is the Oblique Force : To the perpendicular Force.

Then the perpendicular Force, multiplied into the Length of the *Brachium B C minus*, the ſaid Force multiplied into the Diſtance *D C*, will give the Value of the additional Force at *B*, or of the Weight required to reſtore the *Equilibrium* at *A*.

Or to expreſs it Algebraically: Let *o f* expreſs the oblique Force, *p f* the perpendicular Force, and *x* the Force required, or Value of the additional Weight at *A*, to reſtore the *Equilibrium*.

$$BE : DF :: of : pf$$

$$\overline{pf \times BC} - pf \times DC = x.$$

The ſame Rule will ſerve for the ſecond Caſe, if the Quantity found be made negative, and the additional Weight ſuſpended at *B*; or having found the Value of the perpendicular Force, the Equation will ſtand thus, $-pf.\times BC+pf\times DC=-x$, and conſequently, the additional Weight muſt be hanged at *B*; becauſe $-x$ at *A* is the ſame as $+x$ at *B*.

SCHOLIUM II.

Hence it follows alſo, that if, in the firſt Caſe, the Point of Truſion be taken at *C*, the Force at *B*, (or Force whoſe Value is required) will be the whole perpendicular Force; becauſe *C D* is equal Nothing: And if the Point *D* be taken beyond *C* towards *A*, the perpendicular Force puſhing upwards at that *Point*, multiplied into *D C*, muſt be added to the ſame Force multiplied into *B C*, that is, $\overline{pf.\times BC}+pf.\times DC=x$.

The Machine made uſe of to prove this experimentally, was as follows, Fig. 2. The braſs Balance *A B* is 12 Inches long, moveable upon the Centre *C*, with a perpendicular Piece *B C* hanging at the End *B*, and moveable about a Pin at *B*, and ſtopped at its lower End *B* (by the upright Plate *G G*) from being thruſt out of the Perpendicular by the puſhing Pipe *F E*, whoſe lower Point being put into a little Hole at *H*, the upper End, the upper Wire or Point (when put into another little Hole under the Beam *D*) is by the Means of the Worm-ſpring *E F*, preſſing againſt the Plug *E*, to drive forwards the ſaid Wire *b D*, made to puſh the ſaid Beam upwards, with the Force of the Spring. *T S S* is a Stand to which is fixed the Pillar *T C* that ſuſtains the Balance; and it has alſo a Slit *S S* to receive a Shank of the moveable Plate *G G*, to be fixed in any Part of the Slit by a Screw underneath.

Experiment.

Hang on *B b*, as in the Figure; then let *E F* be ſo applied to the Hole *H*, that its upper Wire *b D k* may go through a little Loop at *D*, ſo as not to thruſt the Beam upwards, but be in the ſame Poſition as if it did, that by hanging on the Weight *W*, the *Brachium B C* with *B b* and *F E* may be counterpoiſed; and then the Action againſt *D* and *H* may be eſtimated without the Weight of the puſhing Pipe.

Then drawing down the Head of the Wire *k*, thruſt it into the little Hole under *D*, and *B* will be ſo pulled downwards, as to require the additional Weight of four Ounces to be hung on at *A* to reſtore the *Equilibrium*, when *B H* is four Inches, *B D* three Inches, and the whole Force of the Spring equal to 10 Ounces.

It is not needful here to ſay, that for explaining the ſecond Caſe *B b* is to be ſuſpended at *D*, with the Plate *G G* fixed to ſtop it at the Place *M*, to keep it from being puſhed towards *T*, and that the upper End of *G F E D k* muſt puſh into an Hole made under *B*, in which Caſe the Weight *P* muſt be hanged at *B*, to reſtore the *Equilibrium*.

P. S. In order to ſhew experimentally, that the Force which the Spring exerts in this oblique Truſion is equal to ten Ounces; Take the Beam *A B*, which weighs four Ounces, from the Pedeſtal *C T*, and having ſuſpended at each End *A* and *B* three Ounces, ſupport it under its Centre of Gravity by the puſhing Pipe *E F* ſet upright under it, and you will find that the Beam with the two Weights will thruſt in the Wire *k b* as far as *b*, the Place where the oblique Truſion drives it to.

BALANCE, or, *Libra*, (*Bilanx*, *L.*) is one of the ſix ſimple Powers in *Mechanicks*, which ſerves to find out the Equality or Difference of Weights in heavy Bodies. It is only a double Lever whoſe *Hypomochlion* is at the Centre of its Length.

BALANCE *of the Air*; ſee *Barometer*.

BALANCE *of a Watch or Clock*, is that Part of it, which by its Motion regulates and determines the *Beats*: The circular Part of it is called the *Rim*, and its Spindle the *Verge*: There belongs to it alſo two *Pallats* or *Nuts*, which play in the Fangs of the Crown-wheel. In Pocket Watches that ſtrong Stud, in which the lower Pevet of the Verge plays, and in the Middle of which one Pevet of the Crown-wheel runs, is called the *Potans*, or rather *Potence*. The wrought Piece which covers the Balance, and in which the upper Pevet of the Balance plays, is the *Cock*. The ſmall Spring in new Pocket Watches is called the *Regulator*.

BALANCE, or *Libra*, is the Name of one of the twelve Signs of the *Zodiack*, into the firſt Degree of which when the Sun comes, the Autumnal Equinox happens, and is on the 12th of *September*.

BALANI, are certain Excreſcences uſually growing to the Shells of the larger Sort of Sea Shell Fiſhes. *L.*

BALANUS (as it is called by ſome) or *Glans*, is the Nut of the Yard covered with the Foreskin; ſometimes the *Clitoris* is ſo called. It often alſo ſignifies a Suppoſitory. *L. Blanchard.*

BALCONY, [in *Architecture*,] a Projecture beyond the Naked of a Wall or Building, ſupported by Pillars or Conſoles, and encompaſſed with a Balluſtrade. This Contrivance is not only made uſe of in Houſes, but alſo in Ships. The Word comes from the *Italian*, *Balcone*, and that from the *Latin*, *Paleus*, or the *German*, *Palk*, a Beam. *Covarruvias* derives it from βάλλειν, *jacere*, aſſerting that Balconies were originally little Turrets over the Gates of Citadels, whence Darts, *&c.* were thrown at the Enemy.

BALKS, [in *Architecture*,] are Poles or Rafters over Out-houſes or Barns; alſo great Pieces of Timber coming from beyond the Sea by Floats; alſo among *Bricklayers*, great Beams, ſuch as are uſed in Scaffolding.

BALKS, [in *Agriculture*,] are Ridges or Banks between two Furrows or Pieces of arable Land.

BALL and *Socket*, is an Inſtrument made of Braſs, with a perpetual Screw to hold any Teleſcope, Quadrant, or Surveying Inſtrument, on a Staff for ſurveying, Aſtronomical, or other Uſes.

BALLAST *of a Ship*, is ſome heavy Matter, as Stones, *&c.* laid in the Hold next to the Keelſon, or falſe Keel, in order to keep a Ship ſtiff, ſo that ſhe may bear the more Sail. The Words about it are *Trench the Ballaſt*, *i. e.* divide it into two or more Parts. *The Ballaſt is ſhot*, that is, 'tis run over from one ſide to the other: When a Ship hath not Ballaſt enough, they ſay ſhe is *walt*.

BALLISTA, an ancient warlike Engine to caſt or ſhoot Darts or Stones, to batter and ſhake City Walls.

BALLISTER, or *Balluſter*, in the Capital of the *Ionick Column*, is the lateral Part of the Scroll, which makes the *Curl-turf*.

BALLISTERS, } [*Balluſtre*, *F.*] are a Row
BANNISTERS, } of ſmall Pillars which ſup-

port a Rail: They are placed on Stairs, and in the Fronts of Galleries, Balconies, *&c.*

BALLIVO *amovendo*, is a Writ to remove a Bailiff out of his Office, for want of ſufficient Living in his Bailiwick. *L.*

BALLON, or *Balon*, is the *French* Word for a large Receiver or Veſſel uſed in Chymiſtry, to receive what is diſtilled or drawn off by the Fire.

BALLON, [in *Architecture*,] is taken for a round Globe, or Top of a Pillar or Peer.

BALLS, or *Ballets*, a frequent Bearing in Coats of Arms; but they are never called ſo in Heraldry, but according to their ſeveral Colours have the following Names;

Beſants, when the Colour is Or.
Plates, when 'tis Argent.
Hurts, when 'tis Azure.
Torteauxes, when 'tis Gules.
Pomeis, when 'tis Vert.
Pellets, *Agreſſes*, or *Ogreſſes*, when Sable.
Golpes, when Purpure.
Orenges, when Tenne.
Guzes, when Sanguine.

And theſe Nine contain all the Colours uſually mentioned in Heraldry.

BALLUSTRADE, [in *Architecture*,] an Aſſemblage of one or more Rows of little turn'd Pillars, high enough to reſt the Elbows on, fixed upon a Terras, or the Top of a Building, or elſe to make a Separation between one Part of it and another. *Du Cange* derives the Word from *Balauſtrum*, or *Balauſtrium*, a Place among the Antients where their Baths were rail'd in.

BALNEUM, a Word much uſed by the Chymiſts; it properly ſignifies a Veſſel of Water, in which the Body, or Cucurbit containing any Matter to be diſtilled, is placed, that ſo the Water heating, may heat the Cucurbit gently and by Degrees. And this is what they call corruptly

BALNEUM *Mariæ*; but it ſhould be *Balneum Maris*, *i. e.* a *Sea* or *Water Bath*. And in reſpect to the Mildneſs of the Heat in this Way of Diſtillation, where the Fire never touches the Cucurbit immediately. *L.* They call ſeveral other gentle Ways of Diſtillation by the Name of *Balneum*; as,

BALNEUM *Vaporoſum*, } where the Veſſel con-
BALNEUM *Vaporis*, } taining the Matter to be diſtilled is heated by the Steam of hot or boiling Water.

BALNEUM *Arenæ* or *Cineris*, which they call alſo ſometimes *Balneum Arenoſum*, and *Balneum Cinereum*, is when the Cucurbit or Retort, or Veſſel holding the Matter to be diſtilled is placed in a Pot of Sand or Aſhes, and ſo is heated by the Heat of the Sand or Aſhes. *L.*

BALSAM, ſignifies 1*ſt*, The Juice of an *Arabian Tree* called *Opobalſamum*, to which are allied the natural Balſams, as that of *Toli*, *Peru*, *&c.*

2*dly*, A ſomething thick and odoriferous, ſpirituous and penetrating Subſtance, of the Conſiſtence of an Ointment, as *Apoplectick Balſam*, *Balſam of Roſes*, *&c.*

3*dly*, A Sort of Liquor drawn or extracted from Gums and reſinous Subſtances with Spirit of Wine.

4*thly*, This Name is given alſo by the Chymiſts to the Solutions and Preparations of ſome Salts, as Balſam of *Saturn*, *Tartar*, *Sal-gem*, &c.

5*thly*, Some particular Preparations of Medicines in this Form are called by this Name, as Balſam of *Sulphur*, &c.

BALSAM of *Saturn*, is a Solution of *Saccharum Saturni* made with Spirit of Oil of Turpentine, and digeſted till the Matter hath gained a Red Tincture.

BAN, is a Proclamation made at the Head of a Body of Troops, or in the ſeveral Quarters of the Army by Sound of Trumpet or Beat of Drums, either for obſerving of Martial Diſcipline, for declaring a new Officer, puniſhing a Soldier, or the like. *F.*

BANDELET, is a *French* Term for one of the Ornaments in Architecture, which they call alſo *Regle*: 'Tis greater than the *Liſt*, but a little leſs than what they call a *Platte-bande*: it encompaſſes the Pillar quite round about like a Ring.

BANDELET, [in *Architecture*,] is any little Band or flat Moulding, as that which crowns the *Dorick* Architrave: 'Tis alſo called *Tenia*, from the *Latin Tænia*, which *Vitruvius* uſes for the ſame thing.

Nave BANDS, [in *Gunnery*,] Hoops of Iron binding the Nave of a Gun-Carriage at both Ends.

BANK, [with *Carpenters*,] a Piece of Fir-wood, unſlit, from four to ten Inches ſquare, and of any Length.

BANK, [in *Common Law*,] ſignifies the Bench or Seat of *Judgment*; but there is another ſort of Bank, where there is a great Sum of Money let out to Uſe, returned by Exchange, or otherwiſe diſpoſed to Profit.

BANK, [*Bancus*, *L.* *Banque*, *F.* *Banco*, *Ital.*] The Word was originally taken into Commerce, from a *Bench* which the firſt Bankers had in publick Places, Markets, Fairs, *&c.* on which they told their Money, wrote Bills, *&c.* It is now a Term applied to certain Societies, Communities, or Corporations, who take upon them the Charge of the Money of private Perſons in order to improve it, or keep it ſecure.

There are ſeveral Banks eſtabliſhed in ſeveral principal trading Cities in *Europe*, as in *Venice*, *London*, *Paris*, *Amſterdam*, *Hambourg*, &c.

The Bank of *Venice*, called *Banco del Gyro*, is the moſt ancient, and that on the Model of which the others are formed. This is a Board of publick Credit and Intereſt, or it is a general and perpetual Purſe for all Merchants and Traders, eſtabliſhed by a ſolemn Edict of the Common-wealth. This Edict enacts, That all Payments of wholeſale Merchandize, and Letters of Exchange, ſhall be in Bank Notes, or in *Banco*; and that all Debtors ſhall be obliged to carry their Money to the Bank, and all Creditors to receive their Money from the Bank; ſo that Payments are performed by a ſimple Transfer from the one Perſon to the other.

So that he who before was Creditor on the Books of the Bank, as ſoon as he has reſigned his Right to another, becomes Debtor, who is entered down as Creditor in his Place; ſo that the Parties only change the Name, without making any effective Payment.

In Matters of Retail, effective Payments are ſometimes made; and alſo when Foreigners would have their Money to carry it off in Specie; or when particular Traders would have a Stock by them to negociate in Letters of Exchange, and the like.

The Neceſſity of theſe effective Payments has given Occaſion to the opening a Fund of ready Money, which has not diminiſhed, but rather augmented the Stock, by Reaſon of the Liberty of withdrawing Money at Pleaſure.

The Capital of this Bank of *Venice* is limited to Five Millions of Ducats, deſigned to be in Readineſs upon any preſſing Occaſion, and the Republick is Security for the Capital. And by this Means the Republick is Miſtreſs of the ſaid Sum of Money without paying any Intereſt for it; and that too without prejudicing the Freedom of Commerce.

Of the Bank of Amſterdam *and* Rotterdam.

The greater Part of the Bills of *Exchange* being paid in Bank Money, it is therefore neceſſary that ſomething ſhould be ſaid of the ſame.

The Bank of *Amſterdam* was eſtabliſhed by an Ordinance of the *States* in the Year 1609, in which it was decreed, That all Bills of Exchange ſhould be paid in Bank Money, and for Merchandize in groſs or current Money, unleſs the Sums were under 300 Florins; and that no Entry ſhould be made, nor any Account ſhould be opened for any Perſon, unleſs he or they pay ſuch a particular Perquiſite to the Book-keepers; the *Eaſt-India* and *Weſterly* Companies being the only People that are exempted from this Charge, they having the Liberty of paying and receiving Money at the Bank without any Charges.

Upon this Injunction by the *States*, the Debtors and Creditors are all obliged, the one to carry their Money to the Bank, and the other to receive it by a ſimple Transfer or Aſſignation from one Man's Account to another.

There formerly was at this Place a Bank for current Money, but they finding it could not be maintained without much Difficulty, were obliged to let it drop; and ſince, the Merchants and Negociators lay under ſome Neceſſity for keeping their current Money in a Caſh-keeper's Hands, and for his Trouble they commonly allow him 1 8th *per Cent.*

In this Manner the Town of *Amſterdam* has the Liberty of Trading without any Trouble, and is render'd the Miſtreſs of the Inhabitants Money without any Moleſtation, by Reaſon none are thought to be leſs rich for having their Money in the Bank; for with Bank Money they may purchace current Money, &c. For Inſtance, Suppoſe that a Merchant in *Amſterdam* wants to be furniſhed with Bank or current Money, he goes to *Dam*, a Place before the Bank or Town-Houſe, and there he agrees with a Caſh-keeper for the *Agio*; which is from 3 to 6 *per Cent.* that is, the Bank Money is ſo much more than what we call groſs or current Money.

The Bank commonly pays either in *Rix Dollars*, *Ducatoons*, or Money of the ſame Fineneſs or Goodneſs; and the receiving the *Ducatoons* but at 60 *Stivers* inſtead of 63, which is their Worth in current Money, and ſo likewiſe other Money in Proportion; for this Reaſon, the Bank receiving and paying the fineſt and moſt valuable Species, it is worth more than the current Money, or the *Schillings* and other baſe Money.

Accompts are kept in the Bank in *Guilders*, *Stivers*, and *Grotes*; ſo that when they enter a Sum upon the Books, they take no Notice of odd *Pennings*, if there ſhould be any Number of *Pennings* above 8, they ſet down one *Grote* or *Denier*, or under 8, they ſet down nothing.

When a Banker, Merchant, or Negociator, has a Bill of Exchange in his Hands, that has been accepted, and which ought to be paid in Bank Money, when it falls due, they endorſe on the Back of the Bill in Words of this Nature, *viz. Pray write in Bank upon my Account the Contents of this Bill of Exchange*; but if the Bill of Exchange is to be tranſported to another Perſon's Account, it muſt be ſo ſpecified in the Endorſement; ſo that the next thing requiſite to be done, is to inform himſelf, whether the Acceptor has made an Entry in the Bank, according to the Tenor of the Bill of Endorſement.

When a Merchant has accepted a Bill of Exchange for Payment, he ought not to fail entring the Contents in Bank as ſoon as the Bill falls due, or cauſe it to be ſo entred by another Perſon, who muſt have a legal Authority for doing the ſame; which is done after the following Manner.

Suppoſe that *A. B.* receives a Bill of Exchange from *London* for 472 *l. Sterling*, the Exchange at 36 *s.* 8 *d.* comes to 5192 *Florins* Bank Money, and this Bill is drawn upon *C. D.* in *Amſterdam*, and the Folio *C. D*'s Account ſtands upon in the Bank Books is 235, he draws a Note upon the Bank after the following Manner:

Folio 235.	*Gentlemen the Commiſſioners of the Bank, pray pay to* A. B. *the Sum of Five Thouſand One Hundred and Ninety Two Florins*; Amſterdam.
Guild. 5192.	

C. D.

If a Man takes up Money by Exchange, the Perſon that is furniſhed with the Bill ought not to pay for the ſame in current Money, without taking a Receipt of the Party that furniſhes him, expreſſing the Sum that was delivered in current Money, the Price of the *Agio*, and the Sum in Bank Money contained in the Bill; for in *Amſterdam*, notwithſtanding the Bills of Exchange carry the Word *Received* plainly and ſimply, nevertheleſs the Value is not reputed paid, which has not been writ in Bank; for if a Man is furniſhed with a Bill, and it ſhould be returned him *proteſted*, he cannot recover the Money that was delivered, without he can produce the Perſon's particular Receipt that furniſhed him with the Bill, to prove that he had paid the Value; for all Bills of Exchange that are drawn in *Amſterdam* upon other Places for above 300 Florins, ought to be writ and paid in Bank, unleſs the Bill expreſly ſays in current Money.

If the Perſon that receives a Bill of Exchange has no Account in the Bank, he may bargain with the Acceptor for the Payment in current Money, by agreeing with him at the Price of the *Agio*, and having agreed and received the Money, he muſt write upon the Back of the Bill a Receipt for the current Money, and the *Agio* at ſo much *per Cent.* for the Value mentioned in the Bill.

If the ſaid Perſon cannot agree with the Acceptor for the *Agio*, he may agree with a Caſh-keeper, or any other Perſon that will pay him the Value; and he may indorſe the Bill, and make it payable to any one that he ſhall agree withal, in this Manner; *Write for me in Bank to ſuch a Perſon's Account, the Contents of this Bill for the Value received of him.*

If Merchants, Negociators, or Bankers, have Occaſion to write in the Bank, and through Infirmities, or otherwiſe, cannot go themſelves in Perſon, but are obliged to deputiſe another Perſon to do it for them, the Perſon they thus deputiſe ought to have a Letter of Attorney to prove his Authority; for without ſuch Warrant the Bill cannot be received, nor can the other Party write; and this Letter of Attorney, by Orders of the Bank, muſt be renewed every ſix Months.

The Bank is ſhut up at ſome particular Times in the Year to balance their Books, in *January* or *February*, and in *July* or *Auguſt*; at which Times it is eight, ten, or fifteen Days ſhut; beſides the abovementioned Times, it is ſhut up at *Chriſtmas*, *Eaſter*, *Whitſontide*, and at the opening of the Fair, which begins the 22d of *September*, beſides other Holidays; but then it is for a ſhorter Time than when they balance their Books.

And to prevent Damages and Riſques in Caſe of Bills falling due, or the Six Days of Grace expiring in the Time of the Bank's being ſhut, the *States* have remedied thoſe Inconveniencies, and regulated the Laws relating to Bills of Exchange in ſuch a Manner, that the Merchant has two or three Days after the Bank is opened, for proteſting, or to uſe the other Diligences requiſite to be obſerved; ſo that there is no Room to be apprehenſive of any Damages if a Bill falls due, or the Days of Grace ſhould be expired in the Time of the Bank's being ſhut, by Reaſon the Law has provided Time enough after the opening of it again, to take a legal Courſe.

The Bank of *Rotterdam* is not ſo conſiderable as that of *Amſterdam*, though the Laws and Cuſtoms relating to them differ very little.

To reduce current Money into Bank Money.

By the Term *current Money*, or *Caſh*, is to be underſtood, the Money that goes in a Kingdom from Hand to Hand in Payment, which the Merchants, Negociators, and Bankers, call *Caſh*, or the Money they keep in Bags or Cheſts; beſides, the current Money is expreſs'd by *Florins*, *Sols*, and *Deniers*, which is what we call *Guilders*, *Stivers*, and *Pennings*.

To reduce current Money into Bank Money, the Rule is this; As 100 current Money, with the *Agio* added to it, is to 100 Bank Money; ſo ſhall the given current Money be to the Bank Money produced by the Operation of this Stating.

Example. Suppoſe 8294 *Guilders*, 17 *Stivers* Current Money, were to be reduced into Bank Money, the *Agio* 5¼ *per Cent.* Say thus:

Cur. Money — *Bank.* — *Gild. St.*
105¼ or 5 *St.* — 100 — 8294 17 *Cur. Mo.*
20 — 20

2105 *Stivers* — 165897 *Stivers*
100

2105) 16589700 (*Gild.* 7881 *St.* 1½
18547
17070
2300
195
20
2105) 3900 (1 *Stiv.*
1795
2
2105) 3590 (1 *Grote.*
1485

Guild. St. Gr.
Bank Mon. 7881 1 1

To reduce Bank Money into current Money.

Example. In 4558 *Guilders* Bank Money, how much current Money, the *Agio* at 5 *per Cent.*?

If 100 Bank —— 105 Current — 4558 Bank
105 Multiply

22790
45580

1|00) 4785|90

The current Money is *Guilders* 4785 $\frac{9}{10}$, or 18 *S.*

Or thus,

2|0) 455|8 *Bank.*
Add this 227 18 *Stiv. Agio.*

Guilders 4785 18 *Stivers, Current Money.*

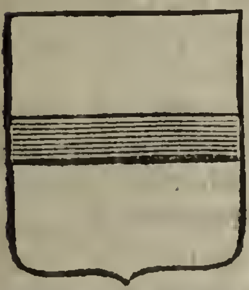
Or thus,

Bank 4558
5
Div. by 1|00) 227|90
20
18|00

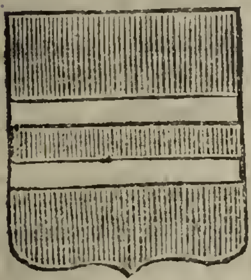
4558 — *Bank.*
227 18 *Agio.*
4785 18 *Curr. Money.*

BANNIMUS, [of *bannir*, *F. to baniſh*,] the Form of Expulſion of any Member from the Univerſity of *Oxford*, affixing the Sentence up in ſome publick Place, as a Denunciation or Promulgation of it.

BANQUETTE, [in *Fortification*,] is a little Foot Pace or Elevation of Earth in Form of a Step, or the Bottom of a Parapet, or that which the Muſqueteers get up upon to diſcover the Counterſcarp, or to fire upon the Enemies in the Moat, or in the Covert-way. Theſe *Banquettes* are generally a Foot and an half high, and almoſt three Foot broad.



BAR, [in *Heraldry*,] one of the Honourable Members of a Coat of Arms, which is divided into two equal Parts: It goes croſs the Eſcutcheon, like the Fez, but contains only the fifth Part of the Field. See the Figure.



BAR GEMEL, [in *Heraldry*, is a double Bar or Bars, that ſtand by Couples, as in the Figure annexed.

Special BAR, [in *Law*,] is that which is more than ordinary, and falls out in the Caſe in Hand upon ſome ſpecial Circumſtance of the Fact.

BAR, [in *Muſick*,] a Line drawn perpendicular through the Note Line, to bar in or compreſs a certain Number of Notes.

BARACK, or *Baraque*, is a Hutt like a little Cottage for Soldiers to lie in in the Camp: Formerly thoſe for the Horſe were called Barracks, and thoſe for the Foot Hutts; but now Barrack is uſed for both indifferently. They are made uſually when the Soldiers have no Tents, or when an Army lies long in a Place in bad Weather, becauſe they keep out Cold and Wet much better than Tents. They are generally made by fixing four ſtrong forked Poles in the Ground, and then laying four others acroſs them; then they build up the Walls with Sods, Wattles, or what the Place affords: The Top is either planked or thatched, or covered with Turf, as they have Convenience.

BARALIPTON, [with *Logicians*,] an imperfect Syllogiſm of two Univerſals, and a particular Negative.

BARATRY, [in *Common Law*, is where the Maſter of a Ship cheats the Owners or Inſurers, either by running away with the Ship, or embezzelling the Goods.

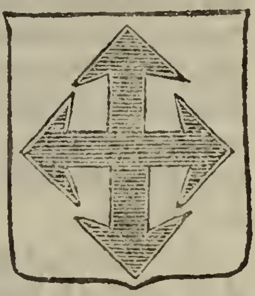
BARBACAN, [in *Architecture*,] a Canal or Opening left in the Walls for Water to come in and go out, when Edifices are raiſed in Places liable to be overflowed; or to drain off the Water from a Terras. The Word comes from the *Italian Barbacane*, which *Spelman* derives from the *Arabick*.

BARBACAN, [in *Fortification*,] an Aperture or Cleft made in the Walls of a Caſtle or Fortreſs, to fire upon the Enemy.

BARBARA, [in *Logick*,] as a Syllogiſm in *Barbara* is one, all the Propoſitions of which are univerſal and affirmative; the middle Term being the Subject in the firſt Propoſition, and the Attribute in the ſecond.

BARBE, a *Military Word*: *To fire en barbe*, is to fire the Cannon over the Parapet, inſtead of putting them through the Embrazures; but then the Parapet muſt be but three Foot and half high. *F.*

BARBED and *Creſted*, [in *Heraldry*,] *i. e. wattled* and *combed*, and ſignifies the Comb and Gils of a Cock, when particulariz'd for being of a different Tincture from the Body.



BARBEE, [in *Heraldry*,] as *Croix Barbee*, *i. e. a barbed Croſs*, being at the Extremities like the barbed Irons that are uſed to ſtrike Fiſh, or other Weapons or Inſtruments commonly call'd *barbed*, which being ſtruck into any thing, cannot be drawn again, without cutting a Hole to make a Paſſage for the Beards; as in the Figure.

A BARE *Pump*, [in a *Ship*,] a Piece of hollow Wood or Metal, to pump Beer or Water out of a Cask.

BARGE *Couples*, [in *Architecture*,] a Beam, &c. mortiſed into another, to ſtrengthen the Building.

BARGE *Courſe*, [*Architecture*,] That Part of the Tiling of an Houſe that projects over the principal Rafters, where there is a *Gabel* or a *Gerkin Head*.

BAROCO, one of the barbarous Words expreſſing the Syllogiſtick Moods in Logick; and in this Mood *Baroco*, the firſt Propoſition muſt be an Univerſal Affirmative, and the two other Negatives.

BAROMETER, a Machine for meaſuring the Weight of the Atmoſphere, and the Variation therein, in order chiefly to determine the Changes of the Weather, from the *Greek* Βαρος *Onus*, and *μέτρον menſura*. The *Barometer* is frequently confounded with the *Baroſcope*, though ſomewhat improperly, the latter, in Strictneſs, being a Machine that barely ſhews an Alteration of the Weight of the Atmoſphere; but 'tis one thing to know that the Air is heavier at one Time than at another, and another to meaſure how much that Difference is; which is the Buſineſs of the *Barometer*.

The *Barometer* is founded on the *Torricellian* Experiment, as 'tis called, from its Inventor *Torricelli*; which is no more than a glaſs Tube filled with Mercury, horizontally ſealed at one End; the other open, and immerg'd in a Baſon of ſtagnant Mercury. Now, as the Weight of the Atmoſphere diminiſhes, the Mercury in the Tube will here deſcend; on the contrary, as it increaſes, the Mercury will again aſcend; the Column of Mercury ſuſpended in the Tube being always equal to the Weight of the incumbent Atmoſphere; as is ſhewn under the Word *Torricellian*.

The Mechaniſm of the Barometer is as follows.

A Glaſs Tube *A B*, *Plate Pneumaticks*, *Fig.* 20. hermetically ſealed in *A*, having its Diameter about 1 10th of an Inch, and its Length at leaſt 3[illegible] Inches, is filled with Mercury ſo juſtly, as not to have any Air over it, nor any Bubbles adhering to the Sides of the Tube; which is beſt done by Means of a Glaſs Funnel, with a capillary Tube: The Orifice of the Tube, filled after this Manner, ſo as to overflow, is cloſely preſs'd by the Finger, ſo as to exclude any Air between it and the Mercury, and thus immerg'd in a wooden Veſſel of a convenient Diameter; ſo however, as not to touch the Bottom: At the Diſtance of 28 Inches from the

Surface of the Mercury, are fixed two Plates *C E*, and *D F*, divided into two Inches, and theſe again ſubdivided into any Number of ſmaller Parts. *Laſtly*, The Tube is incloſed in a wooden Frame, to prevent its being broke, and the Baſon, tho' open to the Air, ſecured from Duſt, and the Barometer is compleat.

Many Attempts have been made to render the Changes in the Barometer more ſenſible, and ſo to meaſure the Atmoſphere more accurately, which has given Riſe to a great Number of Barometers of different Structures: Hence comes the *Wheel Barometer*, *Diagonal Barometer*, *Horizontal Barometer*, *Pendant Barometer*, &c. of each whereof in their Turns.

Des Cartes, and after him *Huygens*, uſed a Tube *A B*, *Fig.* 21. having a Cylindrick Veſſel *C D*, one half of which Veſſel, together with the upper Part of the Tube, were filled with Water, the other half of the Veſſel, and the lower Part of the Tube, with Mercury; but here the Column ſuſpended was larger, and conſequently the Variation greater, yet the Air impriſon'd in the Water getting looſe by Degrees, fill'd the void Space in the Top, and ſo ruin'd the Machine. He then bethought himſelf of placing the Mercury at Top, and the Water at Bottom, in the Manner following; *A D G*, *Fig.* 22. is a bent Tube hermetically ſealed in *A*, and open in *G*; the Cylindrick Veſſels *B C* and *F E* are equal, and about 29 Inches a-part; the Diameter of the Tube is about a Line, that of each Veſſel 15 Lines, and the Depth of the Veſſel about 10; the Tube is filled with Mercury, (the common Barometer ſtanding about 29 Inches) which will be ſuſpended between the Middle of the Veſſel *F E*, and that of the Veſſel *B C*, the remaining Space to *A* being both void of Mercury and Air. *Laſtly*, Common Water, ting'd with a ſixth Part of *Aqua Regis*, to prevent its freezing, is pour'd into the Tube *F G*, till it riſes a Foot above the Mercury in *D F*; when, then the Mercury riſing above the Level of that contained in *F E*, through the Tube *A D*, becomes a Balance to the Weight of the Atmoſphere. As the Atmoſphere increaſes, the Column of Mercury will increaſe; conſequently the Water will deſcend, as the Atmoſphere again grows lighter, the Column of Mercury will deſcend, and the Water aſcend. This Barometer therefore, which is the ſame with that of Dr. *Hook*, will diſcover much minuter Alterations in the Air than the common one; for inſtead of two Inches, the Fluid will here vary two Foot; and by enlarging the Diameters of the Cylinders, that Variation may be ſtill increaſed; but it has this Inconvenience, that the Water will evaporate, and ſo render the Alterations precarious, though the Evaporation may be in ſome Meaſure prevented by a Drop of Oil of Sweet Almonds ſwimming at Top. On Account of this Defect, others have had Recourſe to a

Horizontal, or *Rectangular Barometer*. *A B C D*, *Fig.* 23. the Tube whereof is bent in Form of a Square *B C D*; at the Top of its perpendicular Leg it is joyned to a Veſſel or Ciſtern *A B*; and its Variation accounted on the Horizontal Leg *C D*. Now here the Interval or Space of Variation may be made of any Extent at Pleaſure, and ſo the minuteſt Change in the Air become ſenſible. For the Diameter of the Tube *C D* being given, 'tis eaſy to find the Diameter of the Veſſel *A B*, ſo as that the Scale of Deſcent in the Tube *D C* ſhall have any Proportion to the Scale of Aſcent in the Veſſel *A B*; the Rule being, that the Diameter of the Veſſel is to that of the Tube in a ſubduplicate reciprocal Ratio of their Scales. The Diameters then of *C D* and *A B* being given, together with the Scale or Aſcent of the Mercury in the Veſſel, the Scale of Mercury in the Tube is found thus: As the Square of the Diameter of the Tube, is to the Square of the Diameter of the Veſſel; ſo reciprocally, is the Scale of Mercury in the Veſſel, to the Scale of Mercury in the Tube.

This, and the preceeding Contrivance of *Huygens*, are founded on a Theorem of *Hydroſtaticks*, viz. *That Fluids having the ſame Baſe, gravitate according to their perpendicular Altitude, not according to the Quantity of their Matter*; whence the ſame Weight of the Atmoſphere ſupports the Quickſilver that fills the Tube *A D* and the Ciſtern *B*, as would ſupport the Mercury in the Tube alone.

This laſt however, with its Virtues, has great Defects, for by Reaſon of the Attraction between the Parts of the Glaſs and of the Mercury (which Dr. *Jurin* has ſhewn to be conſiderable) the Length of the Scale, (conſequently the Quantity of Motion) and the Attrition againſt its Sides, eſpecially in ſudden Riſes and Deſcents, the Mercury breaks, ſome Parts of it are left behind, and the Equability of its Riſe and Fall ruin'd. Some therefore prefer the

Diagonal BAROMETER, where the Square of Variation is conſiderably larger than in the common one, and yet the Riſe and Fall more regular than in the others. The Foundation of the *Diagonal Barometer* is this; that in a *Torricellian* Tube *A B*, *Fig.* 24. inclined at any Angle to the Horizon, the Cylinder of Mercury equivalent to the Weight of the Atmoſphere, is to a Cylinder of Mercury, equivalent to the ſame placed in a Vertical Tube, as the Length of the Tube *A B* to the perpendicular Height *B C*. Hence, if the Height *B C* be ſubtriple, ſubquadruple, &c. of the Length of the Tube, the Changes in the Diagonal Barometer will be double, or triple, &c. of the Changes in the Common Barometer. This Barometer will ſcarce allow its Tube to be inclin'd to the Horizon at a leſs Angle than 45°, without undergoing the Inconveniency of the Horizontal one.

Wheel BAROMETER, is a Contrivance of Dr. *Hook*, to make the Alterations in the Air more ſenſible; the Foundation of this is the *Common Vertical Barometer*, with the Addition of a Couple of Weights *A* and *B*, *Fig.* 25. hanging in a Pulley, the one playing at Liberty in the Air, the other reſting on the Surface of the Mercury in the Tube, and riſing and falling with it: Thus is the Motion of the Mercury communicated, by Means of the Pulley, to an Index which turns round a graduated Circle; and thus the two Inches of Vertical Aſcent are here improv'd to four, five, or more, at Pleaſure. But the Friction of the Parts in the Pulley and Index is ſo conſiderable, that unleſs the Machine be made with a great deal of Accuracy, it does not anſwer.

Pendant BAROMETER, is a Machine rather pretty and curious, than uſeful: It conſiſts of a Conical Tube placed vertically, its upper and ſmaller Extreme hermetically ſealed; it has no Veſſel or Ciſtern, its conical Figure ſupplying that Defect; for when fill'd, like the reſt, there will be as much Mercury ſuſtained as is equivalent to the Weight of the Atmoſphere; and as that varies, the ſame Mercury takes up a different Part of the Tube, and ſo becomes of a different Weight. Thus when the Weight of the Atmoſphere is increas'd, the Mercury is driven up into a narrower Part of the Tube, by which Means its Column is lengthened, and, for the Reaſon juſt given, its Weight increas'd. Again, the Atmoſphere decreaſing, the Mercury ſinks into a wider Part of the Tube, by which Means its Column is ſhortened, and its Preſſure accordingly weakened. Thus the ſame Mercury is ſtill a Ballance to the Atmoſphere under all its Variations.

The Inconvenience in this Barometer is, that to prevent the Mercury and Air from changing Places, the Bore of the Tube muſt be very ſmall; which Smallneſs of the Bore renders the Friction ſo ſenſible as to impede its playing.

Marine BAROMETER, is an Inſtrument contrived by Dr. *Hook*, for the Uſe of thoſe that would make a Philoſophical Experiment at Sea.

For the *Mercurial Barometer* requiring a perpendicular Poſture, and the Quickſilver vibrating therein with great Violence upon any Agitation, is therefore uncapable of being made at Sea, (though it hath lately been contrived to be made portable) ſo it remained to find out ſome other Principle, wherein the Poſition of the Inſtrument was not ſo indiſpenſably neceſſary: For this the above-named Perſon invented. Its Deſcription and Uſes the ingenious Capt. *Halley*, in *Philoſ. Tranſact. N*° 269. gives as follows.

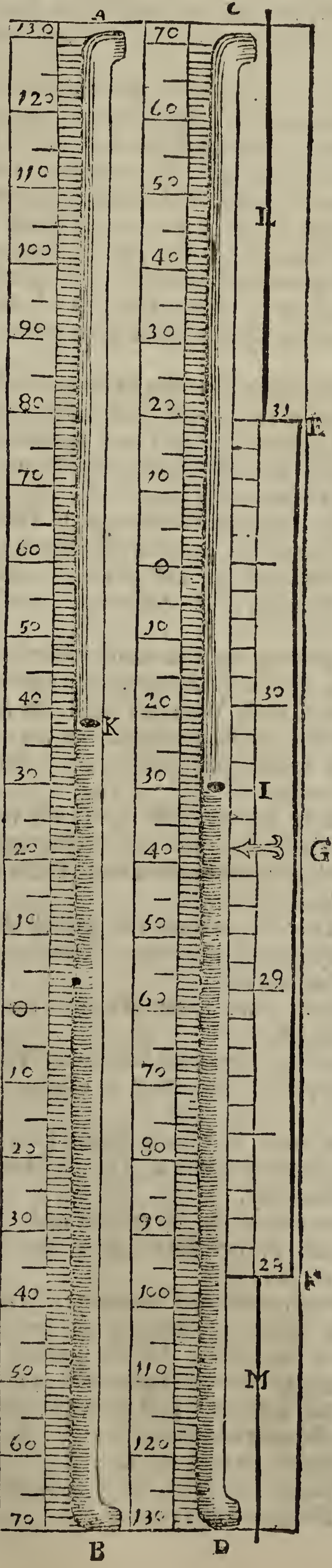
It is above 40 Years ſince, that the *Thermometers* of *Robert de Fluctibus*, depending on the Dilatation and Contraction of included Air by Heat and Cold, have been diſuſed, upon Diſcovery that the Air's Preſſure is unequal; that Inequality mixing itſelf with the Effects of the Warmth of the Air in that Inſtrument; and inſtead thereof was ſubſtituted the *Sealed Thermometer*, including Spirit of Wine, (firſt brought into *England* out of *Italy* by Sir *Robert Southwell*) as a proper Standard of the Temper of the Air, in Relation to Heat and Cold, that Etherial Spirit being of all the known Liquors the moſt ſuſceptible of Dilatation and Contraction, eſpecially with a moderate Degree of either Heat or Cold.

Now this being allow'd as a Standard, and the *Thermometer* that includes the Air being graduated with the ſame Diviſions, ſo as at the Time when the Air was included to agree with the *Spirit-Thermometer* in all Degrees of Heat and Cold, noting at the ſame Time the preciſe Height of the Mercury in the common *Barometers*; it will readily be underſtood, that whereſoever theſe two *Thermometers* ſhall agree. the Preſſure of the Air is the ſame, as it was when the Air was included and the Inſtrument graduated; that if in the *Air-Thermometer*, the Liquor ſtand higher than the Diviſions marked thereon, correſponding with that on the Spirit Glaſs, it is an Indication that there is a greater Preſſure of the Air at that Time, than when the Inſtrument was graduated. And on the contrary, it is to be concluded, when the Air-Glaſs ſtands lower than the Spirit, *viz.* that then the Air is ſo much lighter, and the Quickſilver in the ordinary Barometers lower than at the ſaid Time of Graduation.

And the Spaces anſwering to an Inch of Mercury, will be more or leſs, according to the Quantity of Air ſo included, and the Smallneſs of the Glaſs Cane in which the Liquor riſes and falls; and may be augmented almoſt in any Proportion, under that of the *Specifick Gravity* of the Liquor of the Thermometer to Mercury, ſo as to have a Foot or more for an Inch of Mercury, which is another great Convenience.

In theſe Parts of the World, long Experience has told us, That the Riſing of the Mercury forbodes Fair Weather after Foul, and an Eaſterly or Northerly Wind; and that the Falling thereof, on the contrary, ſignifies Southerly or Weſterly Winds, with Rain and ſtormy Winds, or both; which latter it is of much more Conſequence to provide againſt at Sea, than at Land; and in a Storm, the Mercury beginning to riſe, is a ſure Sign that it begins to abate, as hath been experienced in high Latitudes, both to the Northwards and Southwards of the Equator.

The Form of this Inſtrument is repreſented by the following Figure.



A B repreſents the *Spirit Thermometer* graduated from *O*, or the freezing Point, through all the poſſible Degrees of Heat or Cold of the Air, at leaſt in theſe Climates.

C D is the *Air Thermometer*, graduated after the ſame Manner with the like Degrees.

E F is a Plate applied to the Side of the *Thermometer C D*, graduated into Spaces anſwering to Inches, and Parts of an Inch of Mercury, in the common Barometers.

G, a Hand ſtanding on the Plate, at the Height of the Mercury thereon, as it was when the Inſtrument was graduated; as ſuppoſe here at 29 Inches and an half.

L M, a Wire on which the Plate *E F* ſlips up and down, parallel to the Cane of the *Thermometer C D*.

K, any Point at which the Spirit ſtands at the Time of Obſervation; ſuppoſe at 38 on the *Spirit Thermometer*; ſlide the Plate *E F* till the Hand *G* ſtands at 38 on the *Air Thermometer*, and if the Liquor therein ſtand at 38 likewiſe, then is the Preſſure of the Air the ſame as at the Time of Graduation, *viz.* 29, 5; but if it ſtand higher, as at 30, at *I*, then is the Preſſure of the Air greater, and the Diviſions on the ſliding Plate againſt the Liquor ſhew the preſent Height of the Mercury to be 29, 7 Inches.

This may ſuffice as to the Manner of uſing it.

Capt. *Halley* had one of theſe Glaſſes with him in his laſt *Southern* Voyage; and he ſaith, it never failed to give him early Notice of a Storm, and of all the bad Weather they had.

The ſame ingenious Gentleman, in *Phil. Tranſact. N.* 187, hath an excellent Diſcourſe upon the Reaſons of the Riſe and Fall of the Mercury in fair and foul Weather; the Subſtance of which is as follows.

1. He premiſes the commonly obſerved *Phænomena* of the *Mercurial Baroſcope*; which are,

1. That in calm Weather, when the Air is inclined to Rain, the Mercury is commonly low.

2. That 'tis generally high in good, ſerene, ſettled fair Weather.

3. That it ſinks loweſt of all on very great Winds, though they are not accompanied with Rain; with Relation to the Point of the Compaſs the Wind blows upon.

4. That *cæteris paribus*, the greateſt Height of the Mercury is found, when an Eaſterly or North-eaſterly Wind blows.

5. That in calm froſty Weather, the Mercury generally is high.

6. That after very great Storms of Wind, when the Mercury hath been low, it uſually riſes again very faſt.

7. That more Northerly Places have a greater Alteration of the Riſe and Fall of the Mercury than the more Southerly.

8. That within the Tropicks, and near them, there is little or no Variation of the Mercury's Height in all Weathers.

As to which two laſt *Phænomena*, Mr. *Patrick*, the famous *Barometer-maker*, tells me, That he hath certain Accounts, that the greateſt Variation of the Baroſcope is in the Latitude of 45°. *N.* or *S.* and that the Riſe and Fall gradually decreaſes towards the Equator and Poles, ſo as in either of thoſe Regions ſcarcely to vary at all.

The Theory that Mr. *Halley* advances to ſolve all which *Phænomena*, is this:

1. He ſuppoſes the principal Cauſe of the Riſe and Fall of the Mercury, is from the variable Winds, which are found in the *Temperate Zones*; and whoſe great Inconſtancy here in *England* is moſt notorious.

2. A ſecond Cauſe is the uncertain Exhalation and Precipitation of Vapours lodging in the Air, whereby it comes to be at one time much more crowded than at another, and conſequently heavier; but thoſe latter, in a great Meaſure, depend upon the former. Now from theſe Principles, he explicates the ſeveral *Phænomena* of the *Barometer*.

1. *Why in calm Weather, the Air being inclined to Rain, the Mercury is commonly low?*

That the Mercury's being low is an Indication of Rain, becauſe the Air being light, the Vapours are no longer ſupported thereby, as being become ſpecifically heavier than the *Medium* wherein they floated; ſo that they deſcend towards the Earth, and in their Fall meeting with ſuch aqueous Particles, they incorporate together, and form little Drops of Rain; but the Mercury's being at one Time lower than at another, is the Effect of two contrary Winds blowing from the Place where the *Barometer* ſtands; whereby the Air of that Place is carried both Ways from it, and conſequently, the incumbent Cylinder of Air is diminiſhed, and accordingly the Mercury ſinks; as for Inſtance, if in the *German Ocean*, it ſhould blow a Gale of *Weſterly* Wind, and at the ſame time an *Eaſterly* Wind in the *Iriſh Sea*; or if in *France* it ſhould blow a *Southerly* Wind, and in *Scotland* a *Northern*, it muſt be granted me, that that Part of the *Atmoſphere*, impendent over *England*, would thereby be exhauſted and attenuated, and the Mercury would ſubſide, and the Vapours which before floated in thoſe Parts of the Air, of equal Gravity with themſelves, would ſink to the Earth.

2. *Why in ſerene, good, ſettled Weather, the Mercury is generally high?*

That the greater Height of the *Barometer* is occaſioned by two contrary Winds blowing towards the Place of Obſervation, whereby the Air of other Places is brought thither, and accumulated; ſo that the incumbent Cylinder of Air being increaſed both in Height and Weight, the Mercury preſſed thereby, muſt needs riſe and ſtand high, as long as the Winds continue ſo to blow, and then the Air being ſpecifically heavier, the Vapours are better kept ſuſpended, ſo that they have no Inclination to precipitate and fall down in Drops; which is the Reaſon of the ſerene good Weather which attends the greater Heights of the Mercury.

3. *Why, upon very great Winds or Storms, tho' accompanied with no Rain, the Mercury ſinks loweſt of all, with Relation to the Point of the Compaſs upon which the Wind blows?*

This is cauſed by the very rapid Motion of the Air in theſe Storms; for the Tract or Region of the Earth's Surface wherein theſe Winds rage, not extending all round the Globe; that ſtagnant Air, which is left behind, as likewiſe on the Sides, cannot come in ſo faſt as to ſupply the Evacuation made by ſo ſwift a Current; ſo that the Air muſt neceſſarily be attenuated when and where the ſaid Winds continue to blow, and that more or leſs according to their Violence. Add to which, that the Horizontal Motion of the Air, being ſo quick as it is, may in all Probability take off ſome Part of the perpendicular Preſſure thereof; and the great Agitation of its Particles, is the Reaſon why the Vapours are diſſipated, and do not condenſe into Drops ſo as to form Rain, otherwiſe the natural Conſequence of the Air's Rarefaction.

4. *Why,* cæteris paribus, *the Mercury ſtands higheſt upon an Eaſterly or North-eaſterly Wind?*

This happens becauſe that in the *Atlantick Ocean* on this Side the 35th Degree of North Latitude, the Weſterly and South-weſterly Winds blow almoſt always *Trade*; ſo that when-ever here the Wind comes up at Eaſt and North-eaſt, 'tis ſure to be chec'k by a contrary Gale as ſoon as it reaches the *Ocean*; wherefore, according to what is made out in the ſecond Remark, the Air muſt needs be heaped over this Iſland; and conſequently the Mercury muſt ſtand high as often as theſe Winds blow. This holds true in this Country, but is not a general Rule for others, where the Winds are under different Circumſtances; and he himſelf hath ſometimes ſeen the Mercury here as low as 29 Inches upon an Eaſterly Wind, but then it blew exceeding hard, and ſo comes to be accounted for by what was obſerved upon the third Remark.

5. *Why in calm froſty Weather, the Mercury generally ſtands high?*

The Cauſe thereof is, That it ſeldom freezes but when the Winds come out of the Northern and North-eaſtern Quarters; or at leaſt, unleſs thoſe Winds blow at no great Diſtance off, for the Northern Parts of *Germany*, *Denmark*, *Sweden*, *Norway*, and all that Tract from whence North-eaſtern Winds come, are ſubject to almoſt continual Froſt all the Winter; and thereby the lower Air is very much condenſed, and in that State is brought hitherwards by thoſe Winds, and being accumulated by the Oppoſition of the Weſterly Winds blowing in the *Ocean*, the Mercury muſt needs be preſs'd to a more than ordinary Height; and as a concurring Cauſe, the ſhrinking of the lower Parts of the Air into leſſer Room by Cold, muſt needs cauſe a Deſcent upon the upper Parts of the Atmoſphere, to reduce the Cavity made by this Contraction to an *Equilibrium.*

6. *Why after very great Storms of Wind, when the Mercury has been very low, it generally riſes again very faſt?*

This, he tells you, he has frequently obſerved, and once found it riſen an Inch and a half in leſs than ſix Hours, after a long continued Storm of South-weſt Wind. This ſeems to be occaſion'd by the ſudden Acceſſion of new Air to ſupply the great Evacuation which ſuch continued Storms make thereof in thoſe Places where they happen, and by the Recoil of the Air, after the Force ceaſes that impelled it; and the Reaſon why the Mercury riſes ſo faſt, is, becauſe the Air being very much rarified beyond its mean Denſity, the neighbouring Air runs in the more ſwiftly to bring it to an *Equilibrium*; as we ſee Water runs the faſter for having great Declivity.

7. *Why in more Northerly Places, the Variations of the Barometer are greater than in more Southerly?*

The Truth of the Matter of Fact is proved from Obſervation made at *Clermont* and *Paris*, compar'd with others made at *Stockholm*, as may be ſeen in the Appendix to Mr. *Paſcal*'s Book *De l'Equilibrie des Liqueurs.* The Reaſon ſeems to be, that the more Northerly Parts have uſually greater Storms of Wind than the more Southerly, whereby the Mercury ſhould ſink lower in that Extreme; and then the Northerly Winds bring the condenſed and ponderous Air from the Neighbourhood of the Pole, and that again being check'd by a Southerly Wind, at no great Diſtance, and ſo heaped, muſt of Neceſſity make the Mercury in ſuch Caſe ſtand higher on the other Extreme.

8. *Why near the Equinoctial, as at* Barbadoes, *and St.* Helena, *there is very little or no Variation of the Height of the Barometer?*

This Remark, above all others, confirms the Hypotheſis of the variable Winds being the Cauſe of theſe Variations of the Height of the Mercury, for in the Places above-named, there is always an eaſy Gale of Wind blowing nearly upon the ſame Point; *viz. E. N. E.* at *Barbadoes*, and *E. S. E.* at St. *Helena*, ſo that there being no contrary Current of the Air to exhauſt or accumulate it, the Atmoſphere continues much in the ſame State: However, upon Hurricanes, the moſt violent of Storms, the Mercury has been obſerved very low, but this is but for once in two or three Years, and it ſoon recovers its ſettled State of about 29 Inches and an half: And there is no Doubt but the ſame thing is in the Eaſt Coaſt of *Africa*, and in *India*, where the *Monſoons* or Winds are *Trade* for half the Year one Way, and half the Year another; only 'tis probable, that there may be ſomething worth noting happen, about the Time of the Change or ſhifting of the Winds; which might be obtained if any Body had the Curioſity to keep the Barometer at our Factories in *India.*

Snowden Hill in *North-Wales*, was meaſured by Mr. *Caſwell*, with Mr. *Adams*'s Inſtruments, and found to be 1240 Yards high.

Mr. *Halley* found by three exact Trials, that the Mercury in the Baroſcope deſcending at its Top 3 Inches 8 10ths, and ſometimes more, and perhaps 4 Inches may be near enough Truth; if ſo, then divide 1240 by 4, the Quotient is 310 Yards; ſo that any Fall of the Mercury 1 Inch, argues an Aſcent of juſt 310 Yards in Height; but according to Mr. *Halley*'s Account of 3, 8 Inches, he makes 30 Yards Height to anſwer to 1 10th of an Inch Fall; we therefore allow juſt 30 Yards (for Mr. *Halley* thought the Fall of Mercury more than 3 Inches 8 10ths;) if ſo, then if Dr. *Hook*'s new Baroſcope will bear Diviſions of 1 10th of an Inch into ten more ſenſible Parts (as I believe it will) each of thoſe ten Parts will anſwer to three Yards, and ſo by its Help one may take the Level of Places very well, to convey Water, *&c.*

When the Mercury is at 30 Inches in the Baroſcope (whence may be computed the middle Height) the Atmoſphere is five Miles and an half high (that is, ſuppoſing the Air to be of the ſame Denſity all along; though in all Probability it is not, but grows more rare in Proportion to its Height, which will much increaſe the Height of the Atmoſphere.)

The ingenious Mr. *Derham*, Rector of *Upminſter*, in *Philoſ. Tranſ.* N° 236, gives an Account of ſome Experiments he made at the Top and Bottom of the Monument; where he found, that at the Height of 32 Feet, the Mercury fell 1 10th of an Inch; and at about 164 Feet, 2 12ths of an Inch, *&c.*

He there alſo deſcribes a *Portable Barometer*, which he conceives might be of great Uſe in ſuch Experiments.

In *Philoſ. Tranſ.* N° 237, he gives a Contrivance to meaſure the Height of the Mercury in the Barometer, by a Circle on one of the Weather Plates, to the Hundredth Part of an Inch exactly.

In *Philoſ. Tranſ.* N° 240, Mr. *Stephen Gray* ſhews alſo a Method of meaſuring the Height of the Mercury in the Barometer, by adapting a double Microſcope furniſhed with a Micrometer to the Baroſcope, by Means of which, the Mercury's Variation may be obſerved to the Thouſandth Part of an Inch.

The following Rules to judge of the Weather by the Barometer, I had from Mr. *John Patrick*, in *Ship Court* in the *Old Bayly*, the *Torricellian Operator*; and they are the Reſult of his own long Experience and Obſervation.

Rules and Obſervations on the various Riſing and Falling of the Mercury, to foreknow the Weather by the Barometer.

1. It hath been obſerved, That the Motion of the Mercury doth not exceed three Inches in its Riſing or Falling, in the Barometer of the common Form.
2. That its leaſt Alterations are to be minded, in order to the right finding the Weather by it.
3. The Riſing of the Mercury preſages, in general, fair Weather; and its Falling foul, as Rain, Snow, high Winds, and Storms.
4. In very hot Weather, the Fall of the Mercury foreſhews Thunder.
5. In Winter the Riſing preſages Froſt; and in froſty Weather, if the Mercury falls three or four Diviſions, there will certainly follow a Thaw; but in a continued Froſt, if the Mercury riſes, it will certainly ſnow.
6. When foul Weather happens ſoon after the falling of the Mercury, expect but little of it; and judge the ſame when the Weather proves fair ſhortly after the Mercury has riſen.
7. In foul Weather, when the Mercury riſes much and high, and ſo continues for two or three Days before the foul Weather is over, then expect a Continuance of fair Weather to follow.
8. In fair Weather, when the Mercury falls much and low, and thus continues for two or three Days before the Rain comes, then expect a great deal of Wet, and probably high Winds.
9. The unſettled Motion of the Mercury denotes uncertain and changeable Weather.
10. You are not ſo ſtrictly to mind the Words that are engraven on the Plates, tho' for the moſt Part it will agree with them, as the Mercury's Riſing and Falling; for if it ſtands at much Rain, and then riſes up to changeable, it preſages fair Weather; although not to continue ſo long as it would have done, if the Mercury were higher; and ſo on the contrary.

And I think my ſelf obliged in Juſtice to tell the World, that I have never ſeen better Weather-Glaſſes of all Kinds made any where, than by Mr. *Patrick*; who doth really deſerve all poſſible Encouragement for the many Experiments he hath made in order to improve the *Barometer*, and which he is always very willing to ſhew to all ingenious and curious Perſons. And tho' I cannot be of Dr. *Leigh*'s Opinion, who in *p.* 16. and 180. of his *Natural Hiſtory of* Lancaſhire, &c. ſaith, Mr. *Patrick*'s Experiments demonſtrate, that the Suſpenſion of the Mercury in the Tube is not cauſed by the Weight of the incumbent Atmoſphere, ſince on a very careful Examination of all Mr. *Patrick*'s Experiments, I find them all accountable by the Doctrine of the Gravitation of Fluids; yet do I really believe the making and conſidering thoſe Experiments hath given Mr. *Patrick* many uſeful Hints for the Improvement of this Inſtrument, and will continue to do ſo daily. His *Pendent Barometer* is very curious and nice, the Scale being graduated for it by an Air-pump; it hath no Ciſtern of ſtagnant Mercury at the Bottom of the Tube, as in the common *Torricellian* Experiment; and the Mercury riſes and falls about 12 Inches inſtead of three, as in the ordinary Barometer: And in a *Diagonal* one (which he very handſomly fits about the Frame of a large Looking-glaſs, with a Thermometer alſo by it, the Mercury riſes and falls near 30 Inches; and) conſequently, the Changes of the Weather will be much ſooner perceptible in theſe Inſtruments, than in the Barometers of the common Form.

Statical BAROMETER, or *Baroſcope*, uſed by Mr. *Boyle*, *Otto*, *Gueric*, &c. is fallacious, and liable to be acted on by a double Cauſe; it conſiſts of a large glaſs Bubble, ballanced by a braſs Weight, in a nice Pair of Scales; for theſe two Bodies being of equal Gravity, but unequal Bulk, if the *Medium* in which they equiponderate be changed, there will follow a Change of their Weight, ſo that if the Air grows heavier, the greater Body being lighter in Specie, will loſe more of its Weight than the leſſer and more compact; but if the *Medium* grow lighter, then the bigger Body will outweigh the leſs.

But the moſt accurate Barometer ever yet invented, is that of Mr. *Caſwell*, the Structure whereof he deſcribes as follows: Suppoſe *A B C D*, *Fig.* 27. a Bucket of Water, wherein is the *Barometer x r e z y o ſ m*, conſiſting of a Body *x r ſ m*, and a Tube *e z y o*. The Body and Tube are both concave Cylinders communicating with each other, made of Tin, or rather Glaſs. The Bottom of the Tube *z y*, has a Leaden Weight to ſink it, ſo as the Top of the Body may juſt ſwim even with the Surface of the Water by the Addition of ſome Grain Weights at Top. The Water, when the Inſtrument is forced, with its Mouth downwards, gets up into the Tube to the Height *y o*. There is added on the Top a ſmall concave Cylinder, which we call the *Pipe*, to diſtinguiſh it from the other at Bottom, which we call the *Tube*; this Pipe is to ſuſtain the Inſtrument from ſinking to the Bottom. *m d* is a Wire, *m ſ*, *d e* two Threads oblique to the Surface of the Water, performing the Office of *Diagonals*. Now while the Inſtrument ſinks more or leſs, by the Alteration of the Gravity of the Air, there where the Surface of the Water cuts the Thread, is formed a ſmall Bubble, which aſcends up the Thread, as the Mercury of the common Barometer aſcends, and *vice verſa*. This Inſtrument, as appears from a Calculation which he annexes, ſhews the Alterations in the Air more accurately than the common Barometer, by 120 Times. He obſerves, that the Bubble is ſeldom known to ſtand ſtill a Minute, that a ſmall Blaſt of Wind which can't be heard in a Chamber, will make it ſink ſenſibly; that a Cloud always makes it deſcend, &c.

BAROMETER, in *Philoſ. Tranſ.* N°. 292, there is a pretty Experiment to ſhew the Cauſe of the Deſcent of the Mercury in the Barometer in Storms, to be the collateral Preſſure or Current of Wind on the Surface of the ſtagnant Mercury in the Ciſtern, which abates the Force of the perpendicular Preſſure, or the uſual Gravity of the erect Column of Air, equal in Baſe to the Orifice of the Tube.

Portable BAROMETER, is one that can be ſafely and conveniently carried about from Place to Place, without the Danger of ſpilling the Mercury out of the Ciſtern, or letting the Air get in at the Bottom of the Tube, or of the Mercury included in the Tube, breaking the Top of it off by the Motion it will be put into by being carried from one Place to another. You may prevent the two former Inconveniencies by tying ſome gentle Leather faſt over the Brim of the Ciſtern, which muſt be of Glaſs, or cloſe grained Wood; and muſt have a Neck or Hollow round the Outſide of the Brim to tie on the Cover of Leather. And the laſt may be remedied, by either a way to ſcrew or ſqueeſe the included Mercury quite up to the Top of the Tube, ſo that the Tube in its Carriage from Place to Place ſhall be always full; or elſe by pinching the Head of the Tube at about an Inch from the Top, ſo as to make it there have a very narrow Neck, not ſo big as a Straw: By which means the Force of the Mercury ſtriking againſt the Top, will be very much bridled, and thereby the Tube ſecured from having its Top broken off.

Phænomena of the Barometer.

The Phænomena of the Barometer are various; the Cauſes aſſign'd for them by ſeveral Authors, as various; nor is its Uſe in predicting the Weather yet aſcertain'd.

On the Top of *Snowdon-Hill*, 1240 Yards high, Dr. *Hailey* found the Mercury lower by 3 Inches 8 10ths than at the Foot thereof; whence it appears, that every 30 Yards the Mercury ſinks 1 10th of an Inch. Mr. *Derham*, from ſome Experiments he made at the Top and Bottom of the *Monument*, allows 32 Feet perpendicular Aſcent to a Fall of the Mercury of 1 10th of an Inch; whence we have not only a Foundation for determining the Height of the Atmoſphere, which on this Foundation (were it equally denſe every where) would not be found more than 5 Miles and 1 10th; but alſo a very accurate Method of meaſuring the Height of Mountains: Thus, if on the Surface of the Earth, the Mercury be at 30 Inches at 1000 Foot high, it will be at 28, 91 Inches; at 2000 Foot, 27, 86; at 3000, 26, 85; at 4000, 25, 87; at 5000, 24, 93; at one Mile, 24, 67; at two Miles, 20, 29; at five Miles 11, 28; at ten Miles 4, 24; at 15 Miles 1, 60; at 20, 0, 95; at 30 Miles, 0, 08; at 40, 0, 012; though it muſt be obſerved, this is on a Suppoſition that the Atmoſphere is equally denſe every where.

The greateſt Height the Mercury has been known to ſtand at in the Barometer at *London*, is 30 Inches 1 8th; its leaſt 28 Inches; its greateſt Height at the Obſervatory at *Paris*, has been found 28 Inches 4 10ths; and its leaſt, 26 Inches 4 10ths of the *Paris* Foot, which exceeds the *London* Foot by $\frac{9}{114}$: And with theſe Obſervations agree others made at *Hall* in *Saxony*, by *Wolfius*. 'Tis true, there is an Experiment wherein the Height of the Mercury is found ſurprizingly to exceed theſe Numbers; Mercury perfectly purg'd being ſuſpended in a Tube, in the *Torricellian* way, at the Height of 75 Feet, though by the leaſt Shake it falls down to the ordinary Height. *See the Accounts of this Phænomenon under the Word* Torricellian.

The Phænomena of the *Barometer*, Mr. *Boyle* obſerves, are ſo very precarious, that 'tis exceedingly difficult to form any general Rules about the Riſe or Fall thereof; even that which ſeems to hold moſt univerſally, *viz. That when high Winds blow, the Mercury is the lower*, ſometimes fails.

Dr. Halley *gives us the following Obſervations.*

That in calm Weather, when the Air is inclin'd to Rain, the Mercury is commonly low; in ſerene good ſettled Weather, high.

That on great Winds, though unaccompanied with Rain, the Mercury is loweſt of all, with Regard to the Point of the Compaſs the Wind blows on. That, *cæteris paribus*, the greateſt Heights of the Mercury are on Eaſterly and North-eaſterly Winds. That after great Storms of Wind, when the Mercury has been low, it riſes again very faſt.

That in calm froſty Weather it ſtands high.

That the more Northerly Places find greater Alterations than the more Southern; and that within the *Tropicks*, and near them, there is little or no Variation of the Height of the Mercury at all.

Dr. Beal *obſerves*,

That *cæteris paribus*, the Mercury is higher in cold Weather than in warm, and uſually in Morning and Evening higher than at Mid-day.

That in ſettled and fair Weather, the Mercury is higher than either a little before or after, or in the Rain; and that it generally deſcends lower after Rain than it was before it. If it chance to riſe higher after Rain, it is generally followed by a ſettled Serenity.

That there are frequently great Changes in the Air, without any perceptible Alteration in the *Barometer.*

For the *Uſe* of *Barometers*, an ingenious Author obſerves, that by their Means we may regain the Knowledge which ſtill reſides in Brutes, and which we forfeited by not continuing in the open Air, as they generally do; and by our Intemperance, corrupting the *Craſis* of our Senſes.

As to the *Predictions from Barometers*, Dr. *Halley* has found, That the Riſing of the Mercury forebodes fair Weather after foul, and an Eaſterly or North-eaſterly Wind.

That the Falling thereof portends Southerly or Weſterly Winds, with Rain, or ſtormy Winds, or both.

That in a Storm, the Mercury beginning to riſe, is a pretty ſure Sign that it begins to abate.

Mr. *Patrick* obſerves, that in hot Weather, the Falling of the Mercury preſages Thunder; that when foul Weather happens ſoon after the Fall of the Mercury, it ſeldom holds long; and the ſame is obſerved, if fair Weather ſucceeds preſently after its Riſe.

Laſtly, Mr. *Derham*, from a long Series of *Barometrical Obſervations* made by Dr. *Scheucher*, at *Zurich*, compar'd with others made by himſelf at the ſame time at *Upminſter*, obſerves, that throughout the whole Year the Mercury was lower at the former Place than at the latter, by ſometimes one, and ſometimes above two Inches; though the Difference at a *Medium* he computes to be about half an Inch; and thence concludes the Situation of *Zurich* to be near a Quarter of an *Engliſh* Mile higher than that of *Upminſter*: He found however, a conſiderable Harmony between the two; the one uſually riſing and falling, and that much or little, as the other did, though this Harmony is not ſo compleat as has been obſerved in *Barometers* nearer home, as at *London*, *Paris*, in *Lancaſhire*, &c.

Cauſe of the Phænomena of the Barometer.

Theſe are the *Phænomena* of the *Barometer*; to account for which, the *Hypotheſes* that have been fram'd are almoſt infinite. Indeed, as the Weight of the Atmoſphere is generally allowed to be the Foundation of the *Barometer*, ſo 'tis generally granted, that the Alterations in the Weight of the Air are the Occaſions of thoſe in the *Barometer*; and yet even this does not obtain univerſally. Dr. *Liſter*, for Inſtance, accounts for the Changes of the *Barometer* from the Alterations of Heat and Cold. This, he ſays, he has often obſerved, that in Storms, *&c.* when the Mercury is at the loweſt, it breaks and emits ſmall Particles, which he calls a Kind of *Fretting*; and argues, that in all Times of its Deſcent, it is more or leſs on the Fret. In this Diſorder, he thinks, its Parts are contracted and brought cloſer together, and for that Reaſon deſcend: Beſides, in the Fretting, they let go little Particles of Air, before incloſ'd in 'em; and theſe riſing into the Top of the Tube, the Mercury muſt ſink, both from the Columns being ſhortened by their Eſcape, and by their lying upon it. Mercury therefore, he adds, riſes either in very hot, or very cold Weather, between the *Tropicks*, &c. as being there in its natural State; and again, in the intermediate Degree of Heat and Cold it falls, as being contracted, and, as it were, convuls'd and drawn together. But this Account, however ingenious, comes far ſhort of accounting for the *Phænomena*; nay, in ſome Reſpects, contradicts them.

The Changes in the Weight of the Atmoſphere therefore, muſt be laid down as the Cauſe of thoſe in the *Barometer*; but then for the Cauſe of that Cauſe, or whence thoſe Alterations riſe in the Atmoſphere, will be no eaſy Matter to determine, there being perhaps no one Principle in Nature, that will account for ſuch a Variety of Appearances, and thoſe too ſo irregular. 'Tis probable the Winds, as driven this way or that way, have a great Share in them; ſome Share too Vapours and Exhalations riſing from the Earth may have; ſome, the Changes in the Air of the neighbouring Regions; and ſome, the Flux and Reflux occaſioned in the Air by the Moon.

Dr. *Halley* thinks the Winds and Exhalations ſufficient, and on their Footing gives us a very probable *Rationale* of the *Barometer*; the Subſtance of what may be ſaid on that Head is as follows:

Firſt then, The Winds muſt neceſſarily alter the Weight of the Air in any particular Country; and that either by bringing together and accumulating a greater Quantity of Air, and ſo loading the Atmoſphere of any Place, which will be the Caſe as long as two Winds blow at the ſame time from oppoſite Points towards the ſame Point: Or by ſweeping away Part of the Air, and removing ſome of the Load, give Room for the Atmoſphere to expand itſelf; which will be the Caſe when two Winds blow at the ſame Time, and from the ſame Point oppoſite-ways; or *Laſtly*, by cutting off the perpendicular Preſſure of the Atmoſphere, which happens as often as any ſingle Wind blows briskly any Way; it being found by Experiment, that a ſtrong Blaſt of Wind, even made by Art, will render the Atmoſphere lighter; and accordingly, the Mercury, in a Tube under which it paſſes, as well as in another at a Diſtance from it, ſubſides conſiderably.

Secondly, The cold nitrous Particles, and even Air itſelf condens'd in the Northern Parts, and driven elſewhere, muſt load the Atmoſphere, and increaſe its Preſſure.

Thirdly, Heavy dry Exhalations from the Earth muſt increaſe the Weight of the Atmoſphere, and heighten its elaſtick Force, as we find the ſpecifick Gravity of *Menſtruums* increas'd by diſſolv'd Salts or Metals.

Fourthly, The Air being render'd heavier from theſe and the like Cauſes, is thereby the more able to ſupport the Vapours, which being likewiſe intimately mixed with it, and ſwimming every where equally throughout it, make the Weather ſerene and fair. Again, the Air being made lighter from the contrary Cauſes, it becomes unable to ſupport the Vapours wherewith it is replete; theſe therefore precipitating are gathered into Clouds, and thoſe in their Progreſs coaleſce into Drops of Rain.

Theſe Things obſerved, it appears very evident, that the ſame Cauſes which increaſe the Weight of the Air, and make it the more able to ſupport the Mercury in the *Barometer*, do likewiſe make a ſerene Sky, and a dry Seaſon; and the ſame Cauſes which render the Air lighter, and leſs able to ſupport the Mercury, do likewiſe generate Clouds and Rain.

Hence, 1*ſt*, When the Air is lighteſt, and the Mercury in the *Barometer* loweſt, the Clouds are very low, and move ſwiftly; and when after Rain the Clouds break, and a calm Sky again ſhines forth, being purg'd of its Vapours, it appears exceedingly bright and tranſparent, and affords an eaſy Proſpect of remote Objects.

2*dly*, When the Air is heavier, and the Mercury ſtands higher in the Tube, the Weather is calm, though ſomewhat leſs clear, by Reaſon the Vapours are diſperſed every where equally; if any Clouds now appear, they are very high, and move ſlowly; and when the Air is heavieſt of all, the Earth is frequently found envelop'd in pretty thick Clouds, which appear to be form'd out of the groſſer Exhalations, and which the Air is then able to ſuſtain, though a lighter Atmoſphere could not.

3*dly*, Hence it is that with us the Mercury ſtands higheſt in the coldeſt Seaſons, and when the Wind blows from the North or North-eaſt Corner; for in that Caſe there are two Winds blowing towards us at the ſame Time, and from oppoſite Corners; there being a conſtant Weſt Wind found in the *Atlantick Ocean*, at the Latitude correſponding to ours. To which we may add, that in a North Wind, the cold condenſed Air of the Northern Parts is brought higher.

4*thly*, Hence, in the Northern Regions, the Variation of the Mercury is more ſenſible than in the Southern ones; the Winds being found more ſtrong, more frequent, more various, and more oppoſite to each other in the former than the latter.

Laſtly, Hence it is, that between the *Tropicks* the Variation of the Mercury is ſcarce ſenſible, the Winds there being extremely gentle, and uſually blowing the ſame Way.

Now, this Account however well adapted to many of the particular Caſes of the *Barometer*, yet comes ſhort of ſome of the principal and moſt obvious ones; and is beſides liable to ſeveral Objections.

For 1*ſt*, If the Wind were the ſole Agent in effecting theſe Alterations, we ſhould have no Alterations without a ſenſible Wind, nor any Wind without ſome Alteration of the Mercury; both which are contrary to Experience.

2*dly*, If two Winds be ſuppoſed blowing from the ſame Place, *viz. London*, oppoſite-ways, *viz. N. E.* and *S. W.* there will be two others blowing from oppoſite Point, *viz. N. W.* and *S. E.* to the ſame Place; which two laſt will balance the firſt, and bring as much Air towards the Point, as the others ſwept from it: Or thus, in Proportion as the Air is carried off *N. E.* and *S. W.* the adjacent Air will croud in from the other Points, and form a Couple of new Currents in the Direction *N. W.* and *S. E.* to fill up the Vacancy, and reſtore the *Equilibrium.* This is a neceſſary Conſequence from the Laws of Fluids.

3dly, If the Wind were the ſole Agent, the Alterations in the Height of the Mercury would only be relative or topical; there would be ſtill the ſame Quantity ſupported at ſeveral Places taken collectively: Thus what a Tube at *London* loſt, another at *Paris*, or at *Piſa*, or at *Zurich*, &c. would at the ſame time gain. But we find the very contrary true in Fact; for from all the Obſervations hitherto made, the *Barometers* in ſeveral Parts of the Globe riſe and fall together; ſo that it muſt be ſome Alteration in the abſolute Weight of the Atmoſphere that accounts for the Riſe and Fall of the Mercury.

Laſtly, Setting aſide all Objections, theſe popular *Phænomena*, the Mercury's Fall before, and Riſe after Rain, are really inexplicable on the Foot of the *Hypotheſis*: For, ſuppoſe two contrary Winds ſweeping the Air from over *London*; we know that few, if any, of the Winds reach above a Mile high; all therefore they can do, will be to cut off a certain Part of the Column of Air over *London*: If the Conſequence of this be the Fall of the Mercury, yet there is no apparent Reaſon for the Rain's following it. The Vapours indeed may be let lower, but 'twill only be till they come into the Air of the ſame ſpecifick Gravity with themſelves, and there they will ſtick as before.

Mr. *Leibnitz* endeavours to ſupply the Defects of this *Hypotheſis* with a new one of his own: He aſſerts, That a Body immerg'd in a Fluid, only weighs with that Fluid while it is ſuſtained thereby; ſo that when it ceaſes to be ſuſtained, *i. e.* fall, its Weight ceaſes to make a Part of that of the Fluid, which by this Means becomes lighter. Thus, adds he, the watry Vapours, while ſuſtained in the Air, increaſe its Weight; but when let fall, ceaſe to weigh along with it. Thus the Weight of the Air is diminiſhed, and thus the Mercury falls, and Rain enſues.

But Mr. *Leibneiz*'s Principle, notwithſtanding the Experiment he brings to confirm it, is falſe, as has been made appear by a counter Experiment of Dr. *Deſaguliers*. For a Body, whether ſpecifically equal, or lighter, or heavier than a Fluid, while it is immerg'd in it, whether it be at reſt, or in Motion, adds to the Fluid a Weight equivalent to that of an equal Bulk of the Fluid; as follows from that Law in *Hydroſtaticks*, *That Fluids gravitate according to their perpendicular Altitudes.* However, were Mr. *Leibnitz*'s Principle true, yet 'tis defective, and that in the ſame Reſpect with Dr. *Halley*'s: Nor would it account for the *Phænomena* more than the other: For, ſuppoſing the Vapours, by being condens'd, to be put into a Motion downwards, and ſo ceaſing to gravitate with the Atmoſphere, they will therefore fall till they reach a Part of the Atmoſphere of the ſame ſpecifick Gravity with themſelves; and there they will hang as before. If the Mercury fail, it will only be during the Time of that Deſcent, for theſe once fixed, the former Gravity is retrieved; or, were it not retrieved, yet no Rain would enſue the Fall of the Mercury.

Barometrical Experiments for meaſuring the Height of the Mountains.

The Height of Mountains, and their Elevation above the Level of the Sea, hath always been thought worthy of the Study of the inquiſitive Philoſopher.

Dicæarchus, one of the ancient *Geographers*, meaſured the Height of ſeveral Mountains, and found Mount *Pelius*, the higheſt of them in *Theſſaly*, by his Obſervation to be 1250 Paces high perpendicularly. Alſo *Cleomedes*, a *Grecian Aſtronomer* and *Geographer*, who lived ſome time before the Birth of our Saviour, aſſerts, that the higheſt Mountain cannot be above 15 *Stadia*, or 9375 *Roman* Feet high.

But *Plutarch*, *Cyclicæ Theor. cap.* x. fixes the perpendicular Height of the higheſt Mountains, as alſo the greateſt Depth of the Sea, only to 10 *Stadia*, or 6250 *Roman Feet.* It will appear by what here follows, that what the Ancients have determined concerning the Height of the Mountains, does not deviate very far from the Truth. Particularly, that the 15 *Stadia* of *Cleomedes*, which makes 9.375 *Roman*, or 10.214 *Paris* Feet, will be found by the following Obſervations to come very near to the Mountains of *Switzerland*, which although they are the higheſt in *Europe*, do not riſe above 10.000 *Paris* Feet above the Level of the Sea; notwithſtanding that ſubſequent Writers, and thoſe too well ſkilled in the *Mathematicks*, have run them to an extravagant and altogether unnatural Height.

It is very probable, that at firſt they went only upon bare Conjectures; but in after-times, when *Geometry* came to be more improv'd, Quadrants, Semi-circles, and other *Geometrical* Inſtruments, came in Uſe, by the Help of which, and by a *Trigonometrical Calculation*, the Heights of Places were capable of being determined more exactly.

But nevertheleſs, how true ſoever the Principles be upon which this Method is founded, how nice ſoever the Inſtruments, and how curious ſoever the Obſerver may be, yet it muſt be own'd that the Method itſelf hath been by undoubted Experiments found, to fall far ſhort of that Accuracy which it ſeems to promiſe; and the more conſiderable the Heights are, the more uncertain it will be.

For, in the firſt Place, as the State of the Air is very different in different Seaſons and different Weather, its Refraction alſo by that Means becomes greatly altered, which cauſes the Tops of Mountains to appear higher at ſome times than they do at others, and at all Times higher than they really are.

But there is another Inconveniency beſides this, which whoever is acquainted with the true State of mountainous Countries muſt needs be ſenſible of; and that is, the great Difficulty that there is of meeting at the Bottom of high Mountains with Plains large enough for a proper horizontal Stand or Baſis to ſuch a Triangle as is requiſite accurately to determine a conſiderable Height, although proper Allowances for the Refraction of the Air.

But the meaſuring the reſpective Heights of Places, and their Elevation above the Level of the Sea, hath been much promoted by the new Invention of the *Torricellian* Tube, which although it may not yet, nor perhaps ever will be brought to an abſolute Degree of Certainty, by Reaſon of the Inconſtancy of the Air, yet it is in many Reſpects to be preferred before the *Trigonometrical* one, and has been found in many Reſpects to come nearer the Truth, and does by a new and ſingular Scale lead us from the very Horizon of the Sea to the Tops of the higheſt Mountains, a Diſtance far beyond the Reach of *Geometrical Inſtruments.*

This new Method is founded upon that eſſential Property of the Air, its Gravity or Preſſure. As the Column of Mercury in the Barometer is counterpoiſed by a Column of Air of equal Weight, ſo whatever Cauſes will make the Air heavier or lighter, the Preſſure of it will be thereby increaſed or leſſened, and of Conſequence the Mercury will riſe or fall.

Again, the Air is more or leſs condenſed or expanded, in Proportion to the Weight or Force which preſſes it: Hence it is, that in *England*, *Holland*, and the maritime Provinces of *France*, and in general all thoſe Countries which border upon the Sea, the Mercury ſtands higheſt; that the higher you remove from the Sea into the midland Countries, the lower will the Mercury deſcend, becauſe the Air alſo becomes more rarified and lighter; and that it falls loweſt upon the Tops of the higheſt Mountains, and theſe Heights of the Mercury are in different Places reciprocally as the Expanſions of the Air.

Several learned Men have attempted from theſe Principles, ſupported by a competent Number of Experiments, to derive and frame proper Tables, by the Help of which the Height of any Place may be determined, if the Height of the *Barometer* be given, or the Height of the *Barometer* determined from the given Altitude of the Place; and alſo the Expanſions of the Air ſettled as they anſwer to every Inch or Part of an Inch in the *Barometer.*

To paſs over the firſt Experiment of this Kind, which was made in the Year 1648, (but a few Years after the Invention of the *Torricellian* Tube was made publick in *France* by Father *Merſenne*) by M. *Perier*, by the Directions of M. *Paſcall*, upon the higheſt Mountain in *Auvergne*, viz. *Puy de Domme* near *Clermont*, the Height of which was thereby determined to 500 *French* Toiſes, or 3000 *Paris* Feet. Alſo to paſs by thoſe made ſome time after in 1661, 1665, and 1666, by *George Sinclair*, Profeſſor of Philoſophy in the Univerſity of *Glaſgow*, upon the Cathedral of the Univerſity, upon ſeveral high Mountains in *Scotland*; and alſo in ſome *Wells* and *Coal-pits*; we ſhall only obſerve, that both Mr. *Sinclair*'s and *Perier*'s Experiments were not ſo much intended to lay the Foundation of a Calculation, whereby to determine the different Heights of the Places, as to prove the Gravity and Preſſure of the Air; a Problem very much controverted at that Time: And to ſhew that the ſame is much more conſiderable in Valleys than at the Top of Mountains, and ſtill greater in Proportion at the Bottom of *Wells*, *Mines*, &c.

But this Method was purſued ſtill farther by the Members of the *Royal Academy of Sciences* at *Paris*, particularly by the Order of *Lewis* XIV. when they drew that expenſive Meridian Line a-croſs the whole Kindom of *France.* M. *Marriott*, a celebrated Member of that Academy, was one of the firſt who laid down certain Rules for the Conſtruction of ſuch Tables as might determine both the Elevation of Places above the Level of the Sea from given Altitudes of Mercury, and the Heights of the Air anſwering to every Line of Mercury in the *Barometer* from 28″, where the Mercury was ſuppoſed to ſtand at a *Medium* near the Sea. The Principles he went upon, and the Method he followed, he diſcourſed of at large in his Second Eſſay *De la Nature de l'Air.*

Sometime after, the ingenious Dr. *Edmund Halley*, did, in the Year 1686, ſet about another Calculation, which he derived partly from Principles that agreed with thoſe of M. *Mariotte*, and partly from the ſpecifick Weight of Air and Mercury, which were found by Experiments to be as 1 10, 800; Air being to Water as 1 to 800, and Water to Mercury as 1 to $13\frac{1}{2}$, or very near it.

If ſo as the Column of Mercury in the *Barometer* is counterpoiſed by a Column of Air of equal Weight, a Cylinder of Air of 10, 800 Inches, or 900 Feet, will be equal to 1 Inch of Mercury, and 90 Feet to 1 10th of an Inch, or 75 to 1 12th Part of it. The Height of the Air, as it anſwers to one Inch of Mercury, being thus determined, and the Expanſions of the Air being reciprocally as the Heights of the Mercury, Dr. *Halley*, by the Help of the *Hyperbola* and its Aſymptotes, calculated two Tables, the one ſhewing the Altitude to given Heights of Mercury, and the other the Heights of Mercury to given Altitudes.

Theſe Tables were the firſt that ever were calculated, the Meridian Line having been firſt begun by M. *Picard* in the Year 1669, and continued in 1683. It was farther purſued in the Year 1703, and ſeveral Obſervations of this Kind were made, and the Heights of ſeveral conſiderable Mountains determined, particularly in the Southern Parts of *France*, as well by *Trigonometrical* as *Barometrical Obſervations.* Then M. *Caſſini*, *Jun.* took Occaſion to compare theſe Obſervations with the Rules laid down by M. *Mariotte*, in order to which, and conform to the ſaid Rules, he calculated two Tables, one ſhewing the Height of the Atmoſphere as it anſwers to every Line of the Mercury in the *Barometer*, the other determining the Height of the Atmoſphere above the Level of the Sea at given Altitudes of Mercury.

But having afterwards found upon Compariſon, that the Obſervations that had been made in the Year 1703, did not in the main agree with the Rules made by M. *Mariotte*, and that the Heights of Places, as they appeared by thoſe Obſervations, exceeded, generally ſpeaking, the Number reſulting from the Tables made by him according to the ſame Rules, he thought it neceſſary to calculate two new ones, in which indeed the Reſults are conſiderably greater than in the Tables framed according to the Rules of M. *Mariotte*; inſomuch that for Inſtance, a Place where the Mercury falls to 22 Inches, riſes above the Level of the Sea, according to *Mariotte*, 852 Toiſes, or 5112 *Paris* Feet: And according to *Caſſini*, 1158 Toiſes, or 6948 Feet, which makes a Difference of 1836 *Paris* Feet, or 306 Toiſes.

Dr. *Deſaguliers*, in his *Diſſertation concerning the Figure of the Earth*, hath already ſhewn how far the Obſervations made by thoſe Gentlemen who drew the Meridian a-croſs the Kingdom of *France*, differ from each other, inſomuch that there are not 2 in 9, where the Number of Toiſes ſaid to correſpond to the Heights of the *Barometer*, agree together, and that of Conſequence, the Heights of Mountains as determined by theſe Obſervations are little to be depended on.

Dr. *J. J. Scheuchzer*, in his Journies over the Mountains of *Switzerland*, in order to make Improvements in *Natural Philoſophy*, took an Opportunity to make ſuch Experiments with the *Barometer* as might ſerve to illuſtrate the Qualities of the Air, to ſettle the reſpective Heights of Places, and particularly to ſhew how much theſe Mountains riſe as well above the Level of the Sea, as above other neighbouring Mountains in *France*, *Italy*, *Spain*, &c.

Not to mention the many Experiments he made at different Times, and upon different Mountains, we ſhall only take Notice of one, which is a very conſiderable one, and which enabled him more particularly to examine the two Tables made by *Caſſini* the *Younger*, according to the Rules of M. *Mariotte*, and the Obſervations that had been made by him and others, when the Meridian Line was perfected in 1703.

This curious Experiment was made at a Place called *Pfeffers*, a celebrated Mineral Water in the County of *Sargans*, in the Year 1709, at the Bottom and Top of a Mountain, ariſing from a ſmall Brook called the *Tammina*, to the Height of 714 *Paris* Feet, as appeared by letting a Line drop down from a Tree perpendicularly at Top full to the Bottom. At the Bottom of this Mountain, near to the *Tammina*, the Mercury was, by repeated Experiments, obſerv'd at 25.″ $9\frac{1}{3}$‴, and at the Top it deſcended to 24″ $\frac{1}{3}$‴. So that it fell juſt 10 Lines for 714 Feet, which gives about 71 *Paris* Feet for a Line, if the Heights anſwering to every Line were ſuppoſed to be equal.

Every Toiſe is reckoned at 6 Feet, the Foot is divided into 12 Inches, and the Inch into 12 Lines, which are thus expreſs'd above Toiſes (°) Feet (′) Inches (″) Lines (‴).

The Heights of the *Barometer* at the Bottom and Top of the Mountain being thus given, the Height of it, according to M. *Mariotte*, 116°, 0′, 8″, 11‴, or 696 *Paris* Feet, 8″, 11‴, which falls 17′, 3″, 1‴, ſhort of the true Height, and according to *Caſſini*, 153°, 3′, 8″, that is, 921 *Paris* Feet 8″, which exceeds the true Height by 207 *Paris* Feet 8 Inches; whereby it appears, that the Table made according to the Rules of *Mariotte*, is much preferable to that of *Caſſini* the Younger.

The ſame was likewiſe confirmed by another Experiment made in *June* 1715, upon the Steeple of the Cathedral of *Zurich*. At the Foot of the Steeple the *Barometter* ſtood at 26″, 10‴, and at the Top at 26″, $7\frac{1}{2}$‴, and the Height of the Steeple was found by the Line of 241 *Paris* Feet, 4 Inches, which gives very near 69 *Paris* Feet for one Line. According to the Table of *Mariotte*, the Height of the Steeple ſhould have been of 237 *Paris* Feet; according to *Caſſini*, 265; and according to the new Calculation (of which Mention ſhall be made by and by) made purſuant to the Experiments above, it comes to 243°, 16″, 2‴, or about two Feet more than the true Height.

It appearing by the Experiments made at *Pfeffers*, that from 25″, $9\frac{1}{3}$‴, the *Barometer* deſcends to 24″, $11\frac{1}{8}$‴, that is juſt 10 Lines. For the Height of 714 Feet, and the Expanſions of the Air being reciprocally as the Heights of Mercury, Dr. *Scheucher* undertook, purſuant to theſe Principles, and the Properties of the *Hyperbola*, to calculate a new Table after the following Method.

As the Difference is of the Logarithms of the two given Heights of the Barometer 25″ $9\frac{1}{3}$‴, and 24″, $11\frac{1}{3}$‴, that is $309\frac{1}{3}$, 299 1, or

So the Difference of the Logarithms of the Height of Mercury near the Sea 28″, 1‴ to any leſſer Height, as for Inſtance, 28″, 0‴, that is, 337 — 336, or

to the Height of the Atmoſphere above the Level of the Sea, as it anſwers to one Line of Mercury is——

—— 928 —— 898 1011 —— 1008

142717 714 12906 64′, 6″, 9‴.

Thus the Height of the Atmoſphere at 28″, appears to be of 10°, 4′, 6″, 9‴, but according to *Mariotte*, it is only of 10°, $3\frac{1}{5}$ or 63 Feet, and *Caſſini* ſuppoſes it only at 10°, or 60 Feet.

In like Manner, the Height of the Atmoſphere, from 28″, 0‴, to 27″, 11‴, is found to be 64′, 9″, 2‴. According to the ſame Rule, half the Height of the Atmoſphere, that is, the Height of the Place where the Mercury in the *Barometer* would deſcend to 14 Inches, appears to be 15060′, 3″, 0‴, or 2510°, 0′, 3″, 0‴.

Still upon the ſame Principle the Mercury will deſcend to one Line at the Height of 133, 397 *Paris* Feet above the Level of the Sea, which makes 22, 232 Toiſes 5 Feet, or 11 *Paris* Miles (at 2000 Toiſes the Mile) 232 Toiſes 5 Foot.

But as in order to determine the whole Height of the Atmoſphere, the Logarithm of 1‴ ought to be deducted from the Logarithm of 336‴, or 28″, 0‴; and as that Logarithm is 00000, it follows from thence, that beyond the Place where the Mercury would deſcend to 1‴, the Air is expanded into an indefinite Space.

BARON, [*Baron*, *F.*] hath divers Significations: Firſt, 'Tis uſed for a Degree of Nobility next to a Viſcount. Some of our Hiſtorians ſay, that ſoon after the *Conqueſt* all Barons came to Parliament, and ſat of Courſe as Peers in the Upper Houſe; but they being then very numerous, it grew an Order and a Cuſtom, that none ſhould come but ſuch as the King thought fit to call up by Writ, which Writ ran then, *pro hac vice tantum*. But this State of the Nobility being very precarious, and depending ſolely on the Prince's Pleaſure, they at length got a ſurer Hold, and obtained of the King Letters Patents, and theſe were called *Barons by Patent*, or *Creation*, whoſe Poſterity are now *Lords of Parliament*. And *Cowell* ſaith, there are nevertheleſs Barons by Writ, as well as by Letters Patent; and that thoſe are diſtinguiſhed from theſe by having their own Sirnames annexed to the Title of Lord; whereas Barons by Patent are named by their Baronies. The Original of *Barons by Writ*, *Camden* refers to *Henry* III. and *Barons by Patent or Creation* commenced in the Time of *Richard* II. To theſe *Segar* (*Norroy*) adds a third kind of Baron, which he calls *Baron by Tenure*; and ſuch are the Lords the Biſhops, who, by Virtue of Baronies annexed to their Biſhopricks, ſit in the Upper Houſe, and are called *Lords Spiritual*.

BARON, is alſo an Officer, as *Baron of the Exchequer*, of which the Principal is called *Lord*

Chief Baron, and three others in that Court are his Aſſiſtants.

There are alſo Barons of the *Cinque Ports*, which are two Members of the Houſe of Commons choſen at each Port, and at the two ancient Towns of *Winchelſea* and *Rye*.

BARON is alſo uſed for the Husband in Relation to the Wife; which two in Law are called *Baron* and *Femme*.

The Chief Magiſtrate alſo of the City of *London*, before they had a Lord Mayor, were called *Barons*.

Ever ſince the Reign of *William* the *Conqueror*, the Biſhops hold their Temporaries *per Baroniam*; and by that are obliged to attend the King in Parliament.

Sir *William Temple*, in his Eſſay on *Heroick Virtue*, ſays, that *Baronies* were originally the *larger* Shares of the Land of conquer'd Countries, which the Northern Invaders, (ſuch as the *Goths*, *&c.*) uſed to divide among their Generals and Chief Commanders; as the *ſmaller* Shares divided amongſt the Soldiers were called *Feuda* or *Fees*; and he gueſſes the Word *Baron* to be of Northern Original.

BARON and *Femme*; the Term in *Heraldry*, when the Coat of Arms of a Man and his Wife are borne *per Pale* in the ſame Eſcutcheon, the Man's always on the *Dexter* or Right Side, and the Woman's on the *Siniſter* or *Left*. But here the Wife is not an Heireſs, for then her Coat muſt be borne by the Husband on an Ineſcutcheon, or Eſcutcheon of Pretence.

BAROSCOPE, the ſame with *Barometer*; which ſee.

BARR *of the Port*; See *Shackles*.

BARR, [in *Heraldry*,] is a ſmaller *Feſſe*, containing but the fifth Part of the Field, whereas the *Feſſe* contains the Third.

BARR, [in *Law*,] is when the Defendant in an Action pleads a Plea which is a ſufficient Anſwer, and deſtroys the Action of the Plaintiff for ever.

BAR FEE, is a Fee of Twenty Pence, which every Priſoner acquitted of Felony pays to the Sheriff or Goaler.

BARREL *of the Ear*, [*Anatomy*,] is a pretty large Cavity behind the *Tympanum* of the Ear; it is about three or four Lines deep, and five or ſix wide. It is lined with a fine Membrane, on which there are ſeveral Veins and Arteries. In this Cavity there are four ſmall ſolid Bones, not covered with a *Perioſteum*, as the reſt of the Bones of the Body are.

BARREL; See in *Fuſey*.

BARREL, a Veſſel or Meaſure for Things liquid. The *Barrel*, Wine Meaſure, contains 42 Gallons, or half of a Hogſhead.

Barrel, is alſo uſed for a certain Quantity or Weight of ſeveral Merchandizes, which is various as the Commodities vary. In this Senſe we ſay, a *Barrel* or *Cask* of Herrings or Mackerell, 12 whereof make a Laſt. A *Barrel* of Gun-powder for Ships is ordinarily about 100 Pounds Weight. Authors derive the Word from the *Spaniſh*, *Barile*, an earthen Veſſel with a wide Belly and narrow Neck. The *Roman Barrel*, according to *Vigenere*, contains four *Congia*, or 76 Pints, and weighs 170 Pound, 10 Ounces.

BARRELS *of Earth*, uſed in *Fortification*, are a Sort of half Hogſheads, which being filled with Earth, ſerve for Parapets; as alſo to break the Galleries made in the Ditch, and to roll into the Breaches.

BARRETOR, [*Barredator*, *L. Barrateur*, *F.*] in *Law*, ſignifies a common Wrangler, Stirrer up, or Maintainer of Suits and Quarrels, either in Court or Country.

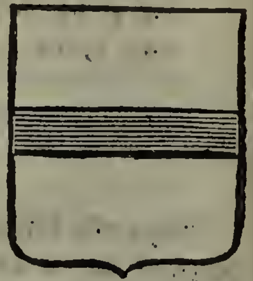
BARRETRY, a Word uſed in *Policies of Inſurance* for Ships, and ſignifies Diſſentions and Quarrels among the Officers and Seamen.

BARRIERS, [in *Fortification*,] are great Stakes, about four or five Foot high, placed at the Diſtance of eight or ten Foot from one another, with their Tranſoms or overthwart Rafters, to ſtop either Horſe or Foot that would enter or ruſh in with Violence. Theſe *Barriers* are commonly ſet up in the void Space between the Citadel and the Town in Half-moons, *&c.*

BARRICADO, [*Barricade*, *F.*] a warlike Defence of empty Barrels, and ſuch like Veſſels filled with Earth, Stones, Carts, Trees cut down, againſt an Enemy's Shot or Aſſault; but generally are Trees cut with ſix Faces, which are croſs'd with Battoons as long as a Half-Pike, bound about with Iron at the Feet. Theſe are uſually ſet up in Paſſages or Breaches to keep back as well the Horſe as the Foot.

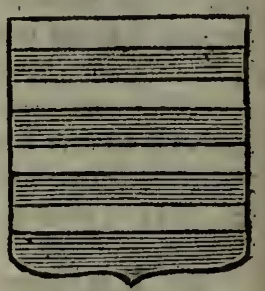
BARRISTERS, [in *Common Law*,] are of two Sorts; 1. The *Outward* or *Utter Bariſters*, who by their long Study in, and Knowledge of the Law (which muſt be for a Term of Seven Years at leaſt) are called to publick Practice, and undertake the Defence of their Clients Cauſes: Theſe always plead without the Bar. 2. The *Inner Barriſters*, who becauſe they are either *Attorney*, *Sollicitor*, *Serjeant*, or *Council* to the King, are allowed, out of Reſpect, the Privilege of Pleading within the Barr. But at the *Rolls*, and ſome other inferior Courts, all *Barriſters* are admitted within the Barr. *Blunt.*

BARRULET, [in *Heraldry*,] is a Fourth Part of the Bar, or half of the Cloſet, as in the Eſcutcheon.



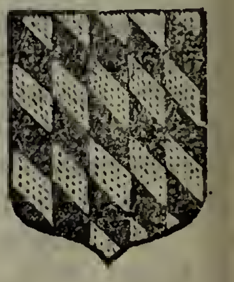
BARRY, when an Eſcutcheon is divided *Barrways* into an even Number of Partitions, 'tis to be expreſsd in Blazon by the Word *Barry*, and the Number of Pieces is to be ſpecified. But if the Diviſions be odd, then the Field muſt be firſt nam'd, and the Number of Bars expreſs'd. See *Paly*.

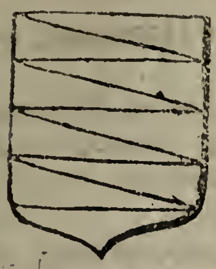
BARRY. [in *Heraldry*.] We underſtand it to be a Shield divided tranſverſe into 4 or 6 or more equal Parts, and conſiſting of two or more Tinctures interchangeably diſpoſed, as in the Figure.



BARRY-BENDY, is when an Eſcutcheon is divided evenly, both *Bar* and *Bend-ways*, as thus:

Barry, *Bendy*, *Argent*, and *Sable*.





BARRY-PILY, is when a Coat is thus divided; and it is to be Blazoned, *Barry-Pily*, of Eight Pieces. *Vid. Guillim*, p. 279.

BARTER, a Word uſed for the Exchange of Wares for Wares.

BARYCOLA, [of Βαρὺ *dully*, and ἀκούω, *Gr. to hear*,] a Dulneſs, Thickneſs, or Hardneſs of Hearing.

BARYPHONY, is a Difficulty in Speaking.

BASE, [in *Fortification*,] is the exterior Side of the Polygon, *viz.* the imaginary Line which is drawn from the Flank'd Angle of a *Baſtion* to that which is oppoſite thereto.

BASE, or *Baſis*, [in *Architecture*,] is the Foot of a Pillar that ſuſtaineth it, or that Part which is under the Body, and lies upon the Pedeſtal or Zocle when there is any: Therefore 'tis not uſed for the loweſt Part of a Column, but for all the ſeveral Ornaments or Mouldings which reach from the *Apophyges*, or the Riſing of the Shafts of Pillars to the *Plinth*.

BASE, [in *Fortification*,] is the Level Line on which any Work ſtands, and which is even with the Campaign.

Diſtinct BASE, [in *Opticks*,] is that preciſe Diſtance from the Pole of a convex Glaſs, in which the Objects which are beheld through it appear diſtinct and well defin'd, and is the ſame with what is called the *Focus*.

BASE FEE, or *Baſe Eſtate*, is a Holding at the Will of the Lord.

BASE COURT, [in *Law*,] is any Court that is not of Record.

BASE *of a Triangle.* Any one Side of a Triangle may be called the *Baſe*, but uſually, and moſt properly, that Side which lies parallel to the Horizon is taken for the *Baſe*. 'Tis alſo the ſame as to any Right-lin'd Figure.

BASE *of any ſolid Figure*, is its lowermoſt Side, or that on which it ſtands.

BASE *of a Conick Section*, (if it have one) is a Right-line in the *Hyperbola* and *Parabola*, ariſing from the common Interſection of the *Secant Plane* and the *Baſe* of the *Cone*.

BASE, the leaſt Sort of Ordnance, the Diameter of whoſe Bore is an Inch and a Quarter, Weight 200 Pounds, Length 4 Foot, Load 50 Pound, Shot half a Pound Weight, and 1 1 8th Inch Diameter.

BASE RING *of a Cannon*, is the great Ring next behind the Touch-hole.

BASE POINT, *in an Eſcutcheon*: See *Eſcutcheon.*

BASE TENURE, or holding by Villenage or other cuſtomary Service, as diſtinguiſhed from the higher Tenure, *in Capite*, or by military Service.

BASIL, is the ſloping Edge of a *Chiſſel*, or of the Iron of a Plane uſed in *Joinery*.

BASILARE OS, the ſame with *Sphænoides*, *L.*

BASILICA, is the inner Vein of the Arm, called *Hepatica*, the Liver Vein, it being the inferior Branch of the *Axillaris* divided into three Branches under the Tendon of the *Muſculus pectoralis*.

BASILICA, [*in the ancient Architecture*,] was a great Hall which had two Ranges of Pillars, and two Iſles and Wings with Galleries over them. Theſe great Halls were at firſt made for the Palaces of Princes, afterwards they were turned into Courts of Juſtice, and at laſt into Churches.

BASILICK *Conſtitutions*, were an Abridgment and Reform of the Laws of *Juſtinian*, made in the Reigns of *Baſilius* and *Leo*, (whence they had their Name) and were in Force in the Eaſtern Empire till its Diſſolution.

BASILICUS, *Cor Leonis*, a fixed Star of the firſt Magnitude in the Conſtellation *Leo*; its Longitude is 145°. 21′. Latitude 00. 26. Right Aſcenſion 147 *deg.* 27 *min.*

BASILIOGLOSSUM, [of Βάσις *a Foundation*, and γλώσσα, *Gr. the Tongue*,] (ſee *Hypſiloglosſum*) is a Pair of Muſcles that depreſs the Tongue: It ariſes fleſhy from the Baſis of the *Os Hyoides*.

BASIS, [in *Architecture*,] the Foot which ſupports a Pillar.

BASIS, [in *Anatomy*,] is the upper and broader Part of the Heart, oppoſite to the *Mucro* or Point: Alſo the Foundation of the Bone *Hyoides*.

BASIS, [in *Muſick*,] is the loweſt of all the Parts thereof, which ſerves as a Foundation to the others.

BASKETS *of Earth*: See *Corbeills*.

BASONS *of a Balance*, two Pieces of Braſs or other Matter faſtened to the Extremities of the Strings; the one to hold the Weight, the other the Thing to be weighed; See *Balance*.

BASON is alſo uſed on various Occaſions for a Reſervatory of Water; as the *Baſon of a Jette d'Eau*, or *Fountain*, the *Baſon of a Port*, *of a Bath*, &c.

BASS-RELIEFE: See *Relief.*

BASS ENCEINT, *F.* or *Baſs Encloſure*, the ſame with the *Fauſſe Bray* in Fortification; which ſee.

BASTION, [in *Fortification*,] is now what was anciently called a *Bulwark*: It conſiſts of two *Faces*, as many *Flanks*, formerly a *Gorge*. It is uſually made at the Angles or Forts, of a large Heap of Earth, ſometimes lined with Stone, but uſually faced with Sods. The Lines terminating it are two Faces, two Flanks, and two Demigorges. The Union of the two Faces makes the outmoſt Angle, called the *Angle of the Baſtion*. The Union of the two Faces to the two Flanks makes the Side Angles, called the *Shoulders*, or *Epaules*; and the Union of the two other Ends of the Flanks to the two Curtains, forms the Angles of the Flanks. *F.*

BASTION, [*in the modern Fortification*,] a huge Maſs of Earth uſually faced with Sods, ſometimes with Brick, rarely with Stone, ſtanding out from a Rampart, whereof it is a principal Part: This is what in the ancient Fortification was called *Bulwark*. A *Baſtion* conſiſts of two Faces and two Flanks. The Faces are the Lines *B C* and *C D*, (*Tab. Fortification*, *Fig.* 28.) including the Angle of the Baſtion. The Flanks are the Lines *B A*, *S D*: The Union of the two Faces makes the outmoſt or *Saliant Angle*, called alſo the *Angle of the Baſtion*. The Union of the two Faces to the two Flanks makes the Side Angles, called the *Shoulders*, or *Epaules*. And the Union of the two other Ends of the Flanks to the two Curtains, *the Angles of the Flanks*. *Baſtions* are either ſolid or hollow.

The Foundation of the Baſtion is that great Rule in Fortification, *viz. That every Part of the Works muſt be ſeen and defended from ſome other Part*; Mere Angles therefore are not ſufficient, but Flanks and Faces are indiſpenſibly requiſite. If the Baſtions *E F G* and *H I K* conſiſted of two Faces alone, the Angles *G* and *H* could not be defended from the Lines *F G* or *I H*. But if the Baſtion conſiſts of Flanks and Faces, as *A B C S D*, all the Points may be defended from the Flanks, there being none, *v. g.* in the Face *B C* but what may be defended from the oppoſite Flank *E L*, nor any in the Curtain *A E* but may be defended from the adjacent Flanks *B A* and *E L*, nor any in one Flank *B A*, but may be defended from the other *E L*. For the Proportions of the Faces are not to be leſs than 24 *Rhineland* Perches, nor more than 30. The Flanks are better as they are longer, provided they ſtand at the ſame Angle of the Line of Defence. Hence the Flanks muſt ſtand at Right-angles to the Line of Defence. Indeed, in the ancient Fortification, the Flank is made perpendicular to the Courtine, ſo as to have the Angle out of the Enemy's Eye, but this is now provided for, by ſinking the lower Part of the Flank two or three Perches, as the Line *A S* nearer the Axis of the Baſtion *C H*: Which Part thus ſunk, is better if made concave than rectangular, and if double, with a Ditch between, than if ſingle. The Diſpoſition of the Flanks makes the principal Part of Fortification; 'tis that on which the Defence principally depends, and which hath introduced the various Forms and Manners of Fortifying. If the Angle of the Baſtion be leſs than 60 Degrees, it will be too ſmall to give Room for Guns; and beſides, ſo acute as to be eaſily beaten down by the Enemy's Guns: To which may be added, that it will either render the Line of Defence too long, or the Flanks too ſhort; it muſt therefore be more than 60 Degrees, but whether or no it ſhould be a Right-angle, or ſome intermediate Angle betwen 60 and 90, or even whether or no it ſhould exceed a Right-angle, is ſtill diſputed. Hence it follows, that a Triangle can never be fortified, in Regard either ſome or all of the Angles will be either 60 Degrees, or leſs than 60.

Solid BASTIONS, are thoſe that are filled up entirely, and have the Earth equal to the Height of the Rampart, without any void Space towards the Centre.

Void and hollow BASTIONS, are thoſe that have a Rampart or Parapet ranging only round about their Flanks and Faces, ſo that a void Space is left towards the Centre; and the Ground is there ſo low, that if the Rampart be taken, no Retrenchment can be made in the Centre, but what will lie under the Fire of the Beſieged.

A Flat BASTION, is a Baſtion built in the Middle of a Curtain, when it is too long to be defended by the Baſtion at its Extremes.

A Cut BASTION, is that which has a Re-entring Angle at the Point; ſometimes alſo called, *Baſtion with a Tenaille*; uſed, when without ſuch a Contrivance the Angle would be too acute. We likewiſe give the Term *Cut Baſtion* to ſuch a one as is cut off from the Place by ſome Ditch, *&c.* ſome modern Engineers having found the Art of Fortifying by Pieces detach'd from the reſt. Theſe are alſo called *Ravelines.*

Compoſed BASTION, is when two Sides of the Interior Polygon are very unequal, which makes the Gorges alſo unequal.

A Deformed or *Irregular* BASTION, is that which wants one of its Demi-Gorges, one Side of the Interior Polygon being too ſhort. See *Gorge.*

A Demi-BASTION, hath but one Face and Flank. To fortify the Angle of a Place that is too acute, they cut the Point, and place two Demi-Baſtions, which make a *Tenaille*, or a Re-entring Angle. Their chief Uſe is before a Horn-work or Crown-work.

Double BASTION, is that which on the Plain of the great Baſtion hath another Baſtion built higher, leaving 12 or 18 Feet betwen the Parapet of the lower and the Foot of the higher.

BASTION *Flat.* }
BASTION *Plat.* } If the Diſtance between the Angles of the Interior Polygon be double the uſual Length, then a Baſtion is made in the Middle before the Curtain; but it generally hath this Diſadvantage, that unleſs there be an extraordinary Breadth allowed to the Moat, the turning Angle of the Counterſcarp runs back too far into the Ditch, and hinders the Sight and Defence of the two oppoſite Flanks.

BASTION *Regular*, is that which hath its due Proportion of Faces, Flanks, and Gorges.

BASTON, a *French* Word in *Architecture*, the ſame with the *Tore*; in *Heraldry* the ſame with *Abutton*; which ſee.

BASTON, }
BATTOON, } [of *Baton*, *F. a Staff*,] one of the Wardens of the *Fleet*, being an Officer who attends the King's Courts with a Red Staff, for committing ſuch to Ward who are committed by the Court.

BATEMENT, [in *Carpentry*,] the Remainder of a Piece of Stuff that was cut off; ſo inſtead of asking how much was cut off from ſuch a Piece, they will ask, what *Abatement* that Piece of Stuff had?

BATH. *Cold Baths* have been long baniſhed out of Medicine by the Uſurpations of Chymiſtry, and a Monkiſh Philoſophy. For the Ancients had them in the greateſt Eſteem; and ſome Improvements of Reaſoning in Phyſick from Geometry and Mechanicks, have brought them into tolerable good Countenance again; and the preſent Age can furniſh us with abundance of noble Cures performed by Cold Bathing, which were long attempted in vain by the moſt efficacious Medicines. There are hardly any Chronick Diſeaſes but the *Cold Baths* may be made uſe of to Advantage, if there be nothing peculiar in the Conſtitution to forbid its Uſe; which is Corpulency, and unſound *Viſcera.* In very fat Perſons the Fibres are ſo ſtuffed round, that they have not Room to vibrate or contract with the ſudden Squeeze of the Bath; inſtead therefore of enforcing their Springs, and ſhaking off any unneceſſary Incumberances, they will only be ſtrained to no Purpoſe, and conſequently weakened; for whereſoever an Effort is made to remove any thing by an elaſtick Body, if the firſt Exertion fails, every *Impetus* afterwards languiſhes, and the Spring is ſpoiled. And in unſound *Viſcera*, or where any Part is much weaker than the reſt, ſuch an additional Force will preſs the Fluids upon that Part very much to its Damage, which may be either the burſting of the Veſſels, or promoting the Diſcharge of ſome ill Humours upon that Part, which otherwiſe might drain elſewhere. But where Nothing of this Nature forbids the Uſe of the *Cold Bath*, whatſoever is to be effected by bracing the Solids, invigorating their Vibrations, and accelerating the Blood's Motion, is with Certainty to be had from thence. All Diſeaſes therefore from a ſizy Blood, and a *Lentor* upon the animal Juices, if the Elaſticity of the Veſſels is not worn out with Age or Debauches, will find Relief from this Practice.

Whatſoever Inconveniencies likewiſe proceed from a bad Tranſpiration, or when Humours are thrown upon the Surface which cannot get through the Skin, this Remedy will be of Service in; for upon Immerſion the whole nervous Syſtem is ſo ſhock'd, that the very Capillaries feel the Influence, and the minuteſt Paſſages are forced open by an increaſed Velocity of the circulating Fluids, whereby the Skin will be cleared, and inſtead of entertaining groſs acrimonious Humours, tranſmit only the imperceptible Matter of Perſpiration. And this is the Reaſon why People are ſo brisk and chearful after Bathing, becauſe ſo much is thus forced away by the Preſſure upon the Veſſels, and forcing out their Contents. A Perſon two Foot under Water, ſuſtains a Weight of Water added to that of Air (ſuppoſing the *Area* of his Skin to be 15 Foot) = 2280 *lb.*; for 2, the Number of cubical Feet of Water, preſſing upon a Foot ſquare of the Skin × 76, the Number of Pounds in a cubical Foot of Water is = 152 × 15. The ſuppoſed Number or ſquare Feet on the Surface of the Body is = 2280 *lib. Troy.*

Though it be a general received Notion, that *Bath Water* enters into the Body, and ſo mixes itſelf with the Blood, yet few attend to the Manner how it is poſſible. That Water hath a wonderful Power of inſinuating itſelf into any Bodies, we ſee by a Number of Experiments. Deal Boards will ſwell againſt rainy Weather, the watry Particles floating in the Air, by the Preſſure of the Air upon them, are forced into the ſlender Tubes of the Wood, where they meet with no Reſiſtance, the Particles of Air being too large to enter the ſame. It is certain, however true the contrary may appear to be, that the compounding Particles of Water are leſs than thoſe of Air, being the former will paſs through ſeveral Bodies that the other will not. But nothing ſhews its Force greater, than the faſtening a Piece of Whipcord, or a ſtrong Rope, of what Length you pleaſe, to a Hook or Staple, and at the Bottom of the Cord hanging any Weight ſhort of what will break it, though ever ſo great; for in this Caſe the Weight will riſe by moiſtening the Sides of the Cord with a wet Sponge, whereby a few Particles of Water may overcome any finite Reſiſtance if the Cord would bear it. Now ſince there is but a little Quantity of Water, and that driven into the Sides of the Cord, with a Force not greater than the Weight of a Cylinder of Air incumbent upon the Water; therefore muſt the Water act by ſome Property whereby its Force is greatly augmented, and that can be no other than that of a *Cuneus*: And the Forces of Wedges are to one another reciprocally proportional to the Angles their Edges make; but in Spheres, the greater or leſſer Degree of Curvity is to be conſidered as their Angles, when Spheres are conſidered as Wedges; and the Degrees of Curvity in Spheres are reciprocally as their *Radii*. Now the Particles of Water being ſo infinitely ſmall, leſs by much than thoſe of Air, muſt, when acting as Wedges, have their Powers infinitely increaſed, ſo as to overcome any finite Reſiſtance. Now let the Reſiſtance the Water meets with in entring into our Bodies be what it will, yet 'tis hard to believe it is greater than what is mentioned, which yet a little Quantity of Water will overcome.

The Experiments uſually made to know the Force of Water in penetrating into membranous Subſtances, are generally with the Skins of dead Men, or Beaſts, and therefore not ſo deciſive as if made upon ſuch as are alive; the only Difference then being, that in the living, Steams or Vapours are continually raiſed into the Air through the Pores of the Skin in inſenſible Perſpiration; which is not ſo in thoſe that are dead: Theſe Vapours, though raiſed with a conſiderable Force, are yet unable to withſtand the *Impetus* with which Water endeavours to inſinuate itſelf into contiguous Bodies, being ſo great as above explained. And though the Quantity of perſpirable Matter is very great in 24 Hours, being 5 8ths of the Meat and Drink a Man takes in a Day, yet if we compute the Quantity that expires from any Part of the Skin in a given Time, we ſhall find it too little by far to hinder the Entrance of Water into the Body when we go into a Bath. For it hath been demonſtrated, that the Matter of inſenſible Perſpiration in a Minute is the 1200th Part of the Place it comes from, that is, ℈i. of the Skin perſpires 1 1200 of a Scruple in a Minute; and conſequently, ʒi. of the Skin perſpires 1 1200 of a Dram in a Minute. Now ſuppoſe a ſquare Inch of the Skin weighs ʒ i. then a ſquare Inch perſpires 1 1200 of a Dram in a Minute: But a ſquare Inch of the Skin is preſſed upon when we bathe, more than in the open Air, equal to 96 Drams; for we may conclude, that our Bodies, taking one Part with anorher, are two Foot under Water in Bathing; ſo that every ſquare Inch of the Skin muſt bear the Weight of 24 cubical Inches of Water equal to 96 Drams; for a cubical Inch of Water being ʒ iv. $\frac{384}{1725}$, throwing away the Fraction, 24 cubical Inches muſt be 96 Drams. Now ſince only 1 1200 ʒ i. of Matter is perſpired through a ſquare Inch of the Skin in a Minute, therefore is the Elevation of the perſpirable Matter reſiſted by a Weight 115200 times greater than itſelf; for 1200 + 96 = 115200, how great then muſt be the Celerity with which the perſpirable Matter moves, if we imagine it able to raiſe a Body 115200 heavier than itſelf? Thus would it be, if the whole Quantity of perſpirable Matter evacuated in a Minute, was to exert its Force at once upon the incumbent Weight of Water; but it is ſo far from doing that, that if the Exhalations of the Steams be not continual, as the Preſſure of the Water is, yet the Intervals betwixt the Times they are propelled from the Body, are very ſhort. Suppoſe 60 of them in a Minute, being about the Number of Pulſes that a healthful Man's Artery beats in the ſame time; then will the Quantity of Vapour which exerts its Force at once againſt the incumbent Water be 60 times leſs than firſt aſſigned; which being multiplied by 1200 = 72000, the Number of Parts into which a Dram of perſpirable Matter is divided, one Part only of which exerts its Force againſt 96 Drams of Water in a Second; ſo that the perſpirable Matter that riſes every ſecond muſt raiſe a Weight of 6912000 times greater Number than itſelf, if it reſiſt the Entrance of the incumbent Water; for 90, the Number of Drams of Water incumbent upon an Inch ſquare of the Skin, multiplied by 72000, the Number of Parts into which a Dram of perſpirable Matter is divided, is = 6912000, the Difference between the Quantity of Matter perſpired in a Second, and the Quantity of Water by which its Motion is reſiſted. From the whole of which it is beyond Diſpute, that *Bath Waters* enter into and mix with the animal Juices in *Bathing*; but for a farther Improvement of ſuch Knowlege, we muſt leave it to thoſe who profeſſedly treat on the Subject.

BATHMIS, Βάθμὶς, *Gr. a Step,*] is a Cavity in the Bone of the Arm or Shoulder, on each ſide one; whereinto, when the whole Hand is ſtretched forth and bended, the Proceſs of the undermoſt and leſſer of the long Bones of the Cubit enters, This is alſo called *Trochlea*.

BATRACHUS, [Βάτραχος, *Gr. a Frog*,] is a Tumour under the Tongue, which makes Men croak like a Toad, when they ſpeak. *Blanchard*.

BATTAILE, is an ancient Trial in our Law, which the Defendant in Appeal of Murder, Robbery, or Felony, might chuſe, that is to fight with the Appellant, for Proof whether guilty or not; grown obſolete and wholly diſuſed. *F.*

BATTALION, is a Body of Infantry of about 6, 7, or 800 Men, of which uſually 1 3d were Pikes in the Middle, and the other 2 3ds were Muſkets poſted on the Wings; but the Number of Men is by no Means certain. *Battalions* are uſually drawn up ſix deep, or with ſix Men in File, or one before another; thoſe in Length, or ſide by ſide, are called *Ranks*. Some Regiments conſiſt of but one Battalion; but when they are numerous they are divided into ſeveral Battallions according to their Strength; and ſo that every one may be about 7 or 800.

The Battalions of *French* Guards have commonly but five Companies, becauſe each Company conſiſts of 150 Men. But of other *French* Regiments there go 16 Companies to a Battalion, becauſe they are but 50 Men in a Company. Of the *Swiſs* Guards four Companies make a Battalion, becauſe each Company hath 180 Men.

When a Battalion is to be formed out of the Companies of ſeveral Regiments in a Garriſon, &c. then thoſe of the eldeſt Regiments poſt themſelves on the Right; thoſe of the ſecond on the Left, and ſo all other ſucceſſively on the Right and Left, till the youngeſt fall into the Centre. The Subaltern Officers take their Poſt before their Companies, the Captains on their Right and Left, according to their Degree.

Battalions are divided into three Diviſions, the Muſqueteers in the Right and Left, and the Pikes in the Centre. In marching, when there is not Room for ſo great a Front, they break into Subdiviſions, as the Way and Ground will allow.

The great Art of drawing up a Battalion, is to diſpoſe it ſo as that it may beſt reſiſt a Party of Horſe in an open Field, and that it may with Advantage engage with either Horſe or Foot.

BATTERY, [in *Law*,] is an Act that tends to the Breach of the Peace of the Realm.

BATTERY, [of *battre*, *F. to beat*,] in *Fortification*, is a Place raiſed on Purpoſe where Cannon are planted, from thence to play upon the Enemy; the Platform on which they are fixed being made of Planks that ſupport the Wheels of Carriages, ſo as to hinder the Weight of the Cannon from ſinking them into the Ground, and incline ſomewhat towards the *Parapet* to check the Recoiling of the Pieces.

BATTERIES *of a Camp*, are Places to plant great Guns on, and are uſually ſurrounded with a *Trench* and *Palliſadoes* at the Bottom, as alſo with a *Parapet* on the Top, having as many Holes as there are Pieces of *Artillery*; and with two *Redouts* on the Wings, or certain Places of Arms capable of covering the Troops that are appointed for their Defence.

In all *Batteries*, the open Spaces left to put the Muzzles of the great Guns out at, are called *Embrazures*, and the Diſtances between the *Embrazures*, *Merlons*. The Guns are generally about 12 Foot diſtant one from another, that the Parapet may be ſtrong, and the Gunners have Room to work.

BATTERY *Sunk* or *Buried*, is when its Platform is ſunk or let down into the Ground, ſo that there muſt be Trenches cut in the Earth againſt the Muzzles of the Guns for them to fire out at, and to ſerve for *Embrazures*. This ſort of *Battery*, which the *French* call *En Terre*, and *Ruinate*, is generally uſed on the firſt making of Approaches, to beat down the Parapet of any Place.

BATTERIES *Croſs*, are two *Batteries* which play athwart one another upon the ſame thing, forming there an Angle, and beating with more Violence and Deſtruction, becauſe what one Bullet ſhakes, the other beats down.

BATTERY *d'Enfilade*, is one which ſcours or ſweeps the whole Length of a ſtrait Line.

BATTERY *en Echarp*, is that which plays obliquely.

BATTERY *de Revers*, or *Murdering Battery*, is one that bears upon the Back of any Place.

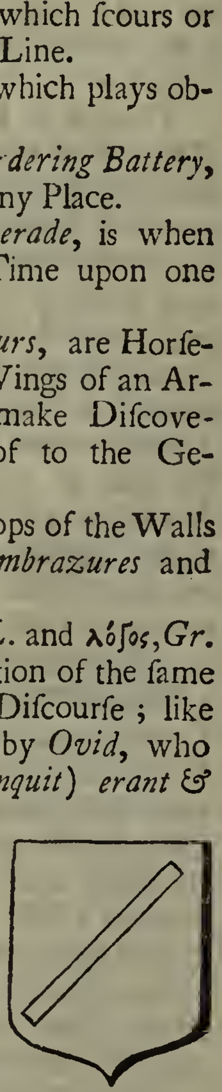
BATTERY *Joint*, or *par Camerade*, is when ſeveral Guns play at the ſame Time upon one Place.

BATTEURS *d'Eſtrade*, or *Scours*, are Horſemen ſent out before, and on the Wings of an Army, a Mile, or two, or three, to make Diſcoveries; which they give an Account of to the General.

BATTLEMENTS, are the Tops of the Walls of Buildings made in the Form of *Embrazures* and *Merlons*, as in fortified Places.

BATTOLOGY, [of *Battus*, *L.* and λόγος, *Gr. Speech*,] is a vain and fooliſh Repetition of the ſame Words over and over again in any Diſcourſe; like rhe trifling Poet *Battus*, mentioned by *Ovid*, who introduces him ſaying, *Montibus (inquit) erant & erant ſub montibus illis*.

BATTOON, [a Term in *Heraldry*,] ſignifying a 4th Part of a *Bend ſiniſter*: It is the uſual Mark of Illegitimacy, and is always borne couped, or cut off, after this Manner. *F.*



It alſo ſignifies the Earl Marſhal's Staff.

BAVINS, [in *War*,] Bruſh Faggots made with the Bruſh at length.

BAY, is a Term uſed by the *Geographers* and Seafaring Men, for an Arm of the Sea coming up into the Land, and terminated in a Nook. It is a Kind of leſſer Gulph, bigger than a Creek, and is larger in the Middle within than it is at the Entrance into it; which Entrance is called the *Mouth of the Bay*.

BEACONS, are Fires maintained on the Sea-Coaſts, to prevent Shipwrecks, and to give Notice of Invaſions, &c.

BEADLE, [in *Law*,] ſignifies a Meſſenger or an Apparitor of a Court, that cites Men to the Court to appear and anſwer.

BEAK, or *Beak-head of a Ship*, is that Part of it which is faſtened to the *Stem*, and is ſupported by a *Knee*; and is the becoming Part or Grace of a Ship.

BEAM, in *Building*, the largeſt Piece of Wood in a Building, being laid a-croſs the Walls, and ſerving to ſupport the principal Rafters of the Roof. No Houſe has leſs than two of theſe Beams, *viz.* one at each End: Into theſe the Girders of the Garret Floor are alſo framed. The Proportion of

Beams near *London* are fixed by Statute as follows: A Beam 15 Foot long muſt be ſeven Inches on one ſide its Square, and five on the other; if it be 16 Foot long, one ſide muſt be eight Inches, and the other ſix.

BEAMS *of a Ship*, are the great main croſs Timbers which hold the Sides of a Ship from falling together, and which alſo ſupport the Decks and Orlops. The Main Beam is next the Main-maſt, and from it they are reckoned by Firſt, Second, or Third Beam. The great Beam of all is called the *Midſhip Beam*.

BEAM *Compaſſes*, is an Inſtrument made in Wood or Braſs, with ſliding Sockets to carry ſeveral ſhifting Points, in order to draw Circles with very long *Radii*: They are of good Uſe in large Projections for drawing the Furniture on Wall-Dials, *&c.*

BEAM, [in *Heraldry*,] is uſed to expreſs the main Horn of a Stag or Buck.

BEAM, a ſort of fiery Meteor in Shape of a Pillar.

BEAM *of an Anchor*, the longeſt Part of it, called alſo the *Shank*.

BEAM-*Filling*, in *Building*, the filling up the vacant Space between the Raiſon and Roof, with Stones or Bricks laid between the Rafters and Raiſon, and plaiſtered on with Loom, frequent where the Garrets are not pargeted or plaiſtered.

To BEAR, [in *Architecture*,] Timber is ſaid to bear at its whole Length, when neither a Brick Wall or Poſts, *&c.* ſtand between the Ends of it; but if either a Brick Wall or Poſts be trimmed up to the Timber, then it is ſaid to bear only at the Diſtance between the Brick Wall or Poſts, and either End of the Timber. Thus *Carpenters* uſually aſk, *What Bearing* ſuch a Piece of Timber has?

The Anſwer is, 10, 12, 15, *&c.* Foot, according to the Length of the whole Timber, or elſe according to the Diſtance between either End of the Timber,

BEAR, a Word uſed by Seamen in ſeveral Senſes. They ſay *a Ship bears Ordnance*, when ſhe carries any great Guns; *ſhe bears a good Sail*, they ſay, when a Ship having her Sails abroad in a Gale of Wind, ſails upright in the Water. When a Ship ſails towards the Shore, ſhe is ſaid *to bear in with the Land*: When a Ship that was to Windward comes under another Ship's Stern, and ſo gives her the Wind, ſhe is ſaid to *bear under her Lee*. If a Ship ſails into an Harbour with the Wind large, or before the Wind, ſhe is then ſaid to *bear in with the Harbour*; and when a Ship keeps off from any Land, ſhe is ſaid to *bear off from it*. When a Seaman would expreſs how any Cape or Place lieth from another, he ſaith it *beareth off ſo*, or *ſo*. In Conding alſo, they ſay, *bear up the Helm*, *i. e.* Let the Ship go more large before the Wind; and *bear up round*, that is, let the Ship go between her two *Sheets* directly before the Wind. *Laſtly*, There is another Senſe of this Word in Reference to the *Burthen of a Ship*, (which Word is derived from hence) for they ſay *a Ship bears*, when having too ſlender or lean a Quarter, ſhe will ſink too deep into the Water with an over-light Freight, and thereby can carry but a ſmall Quantity of Goods.

BEAR is alſo uſed in *Heraldry*: He that hath a Coat of Arms, is ſaid to *bear* in it the ſeveral Charges or Ordinaries that are in his Eſcutcheon; as if there are three Lyons Rampant in it, he is ſaid to *bear three Lyons Rampant*.

BEAR; There are two Conſtellations of the Stars called by this Name, the *Greater* and *Leſſer Bear*, or *Urſa Major* and *Minor*. The *Pole Star* is ſaid to be in the Tail of the *Leſſer*, becauſe that Star is never above two Degrees diſtant from the *N. Pole* of the World.

To BEAR, [in *Gunnery*,] a Piece of Ordnance is ſaid *to come to bear*, when it lies right with, or directly againſt the Mark.

BEARD *of a Comet*, the Rays which the Comet emits towards that Part of the Heavens to which its proper Motion ſeems to direct it; in which the Beard of the Comet is diſtinguiſhed from the Tail, which is underſtood of the Rays emitted towards that Part whence its Motion ſeems to carry it.

BEARER, [in *Architecture*,] a Poſt or Brick Wall trimmed up between the two Ends of a Piece of Timber, to ſhorten its Bearing, or to prevent its bearing with the whole Weight at the Ends only.

BEARING, [in *Navigation*,] ſignifies the Point of the Compaſs that one Place *bears* or ſtands off from another.

BEASANTS; ſee *Balls*.

BEATS, *in a Watch or Clock*, are the Strokes made by the *Fangs* or *Pallets* of the Spindle of the Balance, or of the *Pads* in a Royal Pendulum.

To find the Beats of the Balance in all Watches going, or in one Turn of any Wheel.

Having firſt found out the Number of Turns which the Crown-wheel hath in one Turn of the Wheel you ſeek for (by the Direction given under the Word *Turn*) and then thoſe Turns of the *Crown Wheel* multiplied by its Notches, will give you half the Number of *Beats* in that one Turn of the *Wheel*; becauſe the Balance or Swing hath two Strokes to every Tooth of the *Crown Wheel*: For each of the two *Pallets* hath its Blow againſt each Tooth of the *Crown-wheel*: Wherefore it is, that a Pendulum that ſtrikes Seconds, hath in its *Crown-wheel* only 30 Teeth. To explain what hath been ſaid, take this Example (being the Numbers of a Sixteen Hour-Watch) wherein the Pinion of Report is 4, the Dial-wheel 32, the Great Wheel 55, the Pinion of the Second Wheel 5, *&c.* The Number of Notches in the Crown-wheel 17, being multiplied into 6336 (the Product ariſing from the continual Multiplication of the Quotients 8, 11, 9, 8) gives 107712 for half the Number of *Beats* in one Turn of the Dial-wheel; for 8 times 17 is 136, which is half the Number of *Beats* in one Turn of the Centrate-wheel 40; and 9 times 136 is 1224, the half *Beats* in one Turn of the Second Wheel; and 11 times 1224 is 13464, the half Beats in one Turn of the Great Wheel 55; and 8 times 13464 makes 107712, before found: Which, if multiplied by the two Pallets, that is double it, it gives 215424, which is the Number of *Beats* in one Turn of the Dial-wheel, or 12 Hours. If you would know how many *Beats* this Watch hath in an Hour, 'tis but dividing the *Beats* of 12 Hours into 12 Parts, and it gives 17952, the Train of the Watch, or *Beats* in an Hour. If this be divided into 60 Parts, it gives 299, and a little more, for the *Beats* in a Minute. And ſo you may proceed to Seconds and Thirds, if you will.

4) 32 (8.
———
5) 55 (11.
5) 45 (9.
5) 40 (8.
———
17.

By the Beats and Turns of the Fuſy, the Hours that any Watch will go, may be found thus;

As the *Beats* of the Balance in one Hour : Are to the *Beats* in one Turn of the *Fuſy* :: So is the Number of the Turns of the *Fuſy* : To the Continuance of the Watch's going :

Thus, 20196 : 26928 : : 12 : 16.

To find the Beats of the Balance in an Hour ; the Proportion is,

As the Hours of the Watch's going : To the Number of the Turns of the *Fuſy* : : So are the *Beats* in one Turn of the *Fuſy* : To the *Beats* in an Hour :

Thus, 16 : 12 : : 26928 : 20196

To find the Beats of a Balance in one Turn of the Fuſy ; you have this Proportion ;

As the Number of the Turns of the *Fuſy* : Is to the Continuance of the Watch's going in Hours : : So are the *Beats* in one Hour : To the *Beats* of the Balance in one Turn of the *Fuſy* :

That is, 12 : 16 : : 20196 : 26928.

BEAU PLEADER, [in *Common Law*,] is a Writ upon the Statute of *Malgridge* for not fair Pleading, and this lies where the Sheriff or other Bailiffs in his Court will take a Fine of the Party, Plaintiff or Defendant, for that he plead not fairly.

BECHICKS, [Βηχικὰ, of Βὴξ, *Gr. a Cough*,] are Medicines good againſt a Cough. They are called alſo *Bechical Medicines. Blanchard.*

BED *of the Carriage of a great Gun*, is that thick Plank which lies immediately under the Piece, being as it were the Body of the Carriage.

BED, [in *Maſonry*,] a Courſe or Range of Stones ; and the Joint of the *Bed* is the Mortar between two Stones placed over each other.

BED-MOULDING, [in *Architecture*,] is a Term uſed by the Workmen for thoſe Members in a Corniſh, which are placed below the Coronet or Crown ; and now-a-days a Bed-moulding uſually conſiſts of theſe four Members, 1. An *O——G.* 2. A Liſt. 3. A large Boultine. And 4thly, Under the Coronet another Liſt.

BEDRIP, *Bedrepe*, was the cuſtomary Service which inferior Tenants formerly paid to their Lords, in cutting down their Corn, or doing any Work or Labour in the Field.

BELANDRE, is a ſort of little Veſſel with Sails and Tackle like a Hoy, but broader and flatter ; the Covering of the Deek is raiſed up half a Foot higher than the Gunwale, Gunnel, or Plat-board, as the *French* call it, and between the Gunnel and the Deck there is a Paſſage left free for the Seamen to walk upon : They are chiefly uſed to carry Merchants Goods, and are ſeldom above 24 Tun.

Some will have them call'd *By-landers*, becauſe they ſeldom go out of Sight, but ſail *by the Land.*

BELAY, *aboard a Ship*, ſignifies the ſame as *Eaſtern.* Thus they ſay, *belay the Sheet* or *Tack*, that is *faſten it to the Kennel*, &c.

BELEMNOIDES, [of Βελέμνος *a Dart*, and ἔιδος, *Gr. Shape*,] is the Proceſs or ſhooting forth of the Bone called *Aliformis*, which is fixed in the Baſis of the *Skull. Blanchard.*

BELLANDER ; ſee *Belandre.*

BELLS are ranked among the Muſical Inſtruments of *Percuſſion.* The Parts of a Bell are, the *Body* or *Barrel*, and the *Clapper* on the Inſide ; and the *Ear* or *Cannon*, whereby it is hung to a large Beam of Wood. The Matter of which they are compoſed is a mix'd Metal compounded of an Hundred Pounds of Copper, and Twenty Pounds of Pewter, and that is called *Bell-Metal.* As to the Proportion, it is uſually in Thickneſs at the Edge 1 15th of the Diameter, and the Height 12 times the Thickneſs. *Polydore Virgil* (but erroneouſly) aſſigns the Invention of Bells to Pope *Sabinian*, Succeſſor to St. *Gregory* : For he indeed was not the Inventer, but was the firſt that appointed the canonical Hours to be diſtinguiſhed by them. The firſt Bells we hear of are about the 6th Century : For Hiſtory tells us, that *Loup*, Biſhop of *Orleans*, being at *Sens*, in the Year 610, when the Place was beſieged by *Clotharius*'s Army, frighted away the Beſiegers by ringing the Bells of St. *Stephen*'s.

Some ſay the firſt Bells were made at *Nola* in *Campania*, where St. *Paulinus* was Biſhop, who is ſaid to have firſt brought the Uſe of them into Churches, and that from thence they are called in *Latin*, *Nola* and *Campana* ; others ſay, that they were not ſo called on account of their being firſt invented there, but becauſe the Way of hanging and balancing them, as now in Uſe, was firſt practiſed in *Campania.*

The Cuſtom of *baptizing* and *bleſſing* Bells, is ſaid to be brought in by Pope *John* XIII. but it appears that they were of older Standing, becauſe in a Capitulary of the ſame Pope, there is an expreſs Prohibition of the Practice.

The firſt large Bells in *England* are mentioned by *Venerable Bede* towards the latter End of that Century.

The Sound of a Bell conſiſts in a vibratory Motion of its Parts, much like that of a Muſical Chord. And the Stroke of the Clapper muſt neceſſarily change the Figure of the Bell, and of round make it oval ; but the Metal having a great Degree of Elaſticity, that Part will return back again which the Stroke drove fartheſt off from the Centre, and that even ſome ſmall Matter nearer the Centre than before. So that the two Points which before were the Extremes of the longer Diameter, do then become thoſe of the ſhorter. And thus the external Surface of the Bell undergoes alternate Changes of Figure, and by that Means gives that tremulous Motion to the Air in the which Sound conſiſts.

Mr. *Perrault* aſſerts, that the Sound of the ſame Bell is a Compound of the Sound of the ſeveral Parts of it ; ſo that where the Parts are homogeneous, and the Dimenſions of the Figure uniform, there is ſuch a perfect Mixture of all theſe Sounds, as conſtitutes one uniform ſmooth even Sound, and the contrary Circumſtances produce Harſhneſs.

To confirm this, he obſerves the different Tune of the Bell, according to the Part of it that is ſtruck, and yet ſtrike it where you will, there is a Motion of all the Parts.

He therefore conſiders Bells as compoſed of an infinite Number of Rings, which have different Tones, according to their different Dimenſions, as Chords of different Lengths have ; which when ſtruck, the Vibrations of the Parts immediately ſtruck, determine the Tone ; being ſupported by a ſufficient Number of conſonant Tones in other Parts.

It has been found by Experience, that Bells are heard further, if placed on Plains, than on Hills, and ſtill farther in Vallies than on Plains; the Reaſon of which may be eaſily comprehended, by conſidering the higher the ſonorous Body is, the *Medium* is the rarer, and of Conſequence receives the leſs Impulſe, and the Vehicle is the leſs proper to convey it to a Diſtance.

Mr. *Hauksbee*, and others, by Experiments have diſcovered, that the Sound of a Bell ſtruck under Water, is a Fourth deeper than in the Air, contrary to what *Merſenne* ſays, that it is of the ſame Pitch in either Element.

Some Cities in *China* have been famous for large Bells; as particularly *Nanking*, one of which is ſaid to be near 12 *Engliſh* Feet high, 23 Feet in Circumference, and 7 1 half Feet Diameter, which according to its Dimenſions, is computed to weigh 50000 Pounds. The Figure of it is almoſt Cylindrical, having a Swelling in the Middle, and the Thickneſs of the Metal about the Edges 7 Inches. Theſe Bells are ſaid to have been caſt about 800 Years ſince; but the enormous Weight of theſe Bells having brought down the Steeple, they have lain on the Ground ever ſince.

At *Pekin*, now the Capital of *China*, there are likewiſe ſeven other Bells ſaid to be each 120000 Pounds; but the Sounds of their biggeſt Bells are very mean, being ſtruck with a wooden Mallet inſtead of an Iron Clapper. Yet ſome Travellers tell us, that it throws the Air with ſuch Violence, as to break Windows, and almoſt overturn weak Cottages.

The Tower of *Moſcow* is famous for having a Bell raiſed in it which weighs 176 Tuns, though indeed 200 Tuns were allowed for the making it. It is 24 Foot high, the Clapper 21 Foot long, and weighs ſeven Tuns. At *Ghent* in *Flanders*, at the Tower called *Belfart*, is a Bell named *Roland*, which weighs 11000 Pound Weight. At a Tower at *Erfurd*, in *Upper Saxony*, hangs a Bell weighing 25400 Pounds.

Egelrick, Succeſſor to *Turketule*, Abbot of *Croyland*, about the Year 967, is recorded to be the firſt who perfected an harmonious Ring of Bells in *England*, which were at *Croyland Abbey*; for whereas his Predeceſſor *Turketule* had cauſed a Bell of a prodigious Largeneſs to be made, which he named *Guthlac*, this *Egelrick* added thereto two great ones called *Bartholomew* and *Bertelin*, and two mean ones called *Turketule* and *Tolium*, and likewiſe two little ones, called *Pega* and *Bega*; all which being framed of a proportionable Meaſure, made together a moſt delightful Harmony, not to be equalled in the whole Kingdom, ſaith *Creſſy*, in his Church Hiſtory of *Britain*.

The modern *Greeks*, now under the Juriſdiction of the *Turks*, are not allowed Bells, ever ſince the taking of *Conſtantinople* by the *Turks*, who it ſeems prohibited them, leſt their Sounds ſhould diſturb the Repoſe of Souls, which they fancy wander in the Air; but others are of Opinion, that the *Turks* prohibited the Uſe of Bells to the *Chriſtians* for political Reaſons, leſt the Ringing of Bells might be uſed as a Signal for the putting deſigned Revolts in Execution.

Lobineau is of Opinion, that the Cuſtom of Ringing of Bells when it thundred much, was rather to call People to Church to Prayer for Preſervation againſt the direful Effects of it, than to diſſipate the Thunder.

Mabillon relates, that it was an ancient Cuſtom to ring the Bells for Perſons ready to expire, to give Notice to People to pray for them; and thence comes our *Paſſing-Bell.*

Matthew Paris writes, that the Uſe of Bells was anciently prohibited in the Time of Mourning, though at preſent the Ringing or Tolling of a Bell is a Ceremony of Mourning.

BELL *for Diving*; ſee *Diving*.

BELTS, [in *Aſtronomy*,] two *Faciæ* or Girdles obſerved in *Jupiter*'s Body more lucid than the reſt, and terminated by parallel Lines, being ſometimes broader and ſometimes narrower; nor do they conſtantly take up the ſame Places in his Disk. *Huygens* obſerved a *Belt* in *Mars* in 1656, much broader than thoſe of *Jupiter*, and poſſeſſing the Middle Part of his Disk, but very obſcure. See *Jupiter*.

BEND; at Sea they ſay, *bend the Cable*, when 'tis to be ſeized and made faſt to the Ring of the Anchor; and *to bend two Cables*, is all one with them as to tie them together. To *unbend the Cable*, is to looſen it from the Ring of the Anchor, which is done when a Ship deſigns to be long at Sea. *To bend a Main Sail*, is to make it faſt to the Yard in its proper Place.

BEND, one of the eight honourable Ordinaries in *Heraldry*, containing a 5th when uncharged, but when charged a 3d Part of the Eſcutcheon. It's made by 2 Lines drawn thwartways from the *Dexter chief* to the *Siniſter baſe* Point; thus: He beareth *Or*, a *Bend Sable*.

A *Bend* is ſubdivided into a

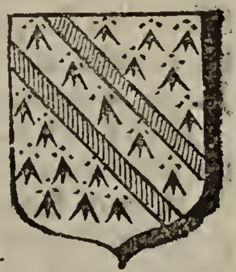
BENDLET, which is the ſixth Part of the *Shield*; a *Garter*, which is the Moiety of a *Bend*; a *Coſt*, which is the 4th Part of a *Bend*; and a *Ribbon*, which is the Moiety of a *Coſt*.

There is alſo a *Bend Siniſter*, which is drawn from the *Siniſter chief* Point to the *Dexter baſe*, and this is ſubdivided into the *Scrape* or *Scarp*, and the *Battoon*, which latter is the 4th Part of the *Bend*.

This *Battoon* is the moſt uſual Mark of Illegitimacy, but then it never extends itſelf quite athwart the *Shield*, but is cut off a little at each End.

When two ſtreight Lines drawn within the *Bend* run nearly parallel to the outward Edges of it, that is called *Voiding*, and he that bears it is ſaid to bear a *Bend voided* thus;

He beareth *Ermine*, a *Bend-voided Gules*.



BENDS, *in a Ship*, are the ſame with the *Wailes* or *Wales*, which are the outmoſt Timbers of a Ship on which the Men ſet their Feet in climbing up: They are reckoned from the Water the firſt, ſecond, and third *Bend* or *Waile*. They help much to ſtrengthen the Ship, and have the Beams, Knees, and Foot-hooks bolted into them.

BENDY, the Term in *Blazonry* for an Eſcutcheon's being divided *Bendways* into an even Number of Partitions, but if they are odd, the Field muſt firſt be named, and then the Number of the *Bends*.

BENEFICES, *Beneficia*, L. All Church Preferments, except Biſhopricks, are by ſome called Benefices, *vid. Godolph. c.* 18. And all Benefices are by the Canoniſts ſometimes called *Dignities*; but we now apply the Word *Dignity* to Biſhopricks, Deaneries, and Archdeaconries, and as ſome will have it, to Prebends.

BENEFICES, are either *Parſonages*, *Vicarages*, or *Donatives*.

Parſonages, are Churches endowed with Glebe, Manſe, Tythes, and all other Duties payable by the Pariſhioners.

Vicarages, are Benefices which were created for the Maintenance of ſuch Clergymen as ſerved in Churches, where ſome or all the Tythes were impropriated. At firſt the Vicar was a mere Curate, but by Degrees ſome of them got a ſettled Maintenance diſtinct from the *Impropriator*, which conſiſted of a Manſe and Glebe, and ſome Portions of Tythes uſually; but in ſome Places only a Penſion from the *Impropriator*. And theſe are what the Law calls *perpetual Vicars*, or *Vicars endowed*.

Donatives, are ſuch as being exempt from the Juriſdiction of the *Ordinary*, are viſitable only of the King or other ſecular Patron, who puts his Clerk into Poſſeſſion of the Benefice by Virtue of an Inſtrument under Hand and Seal, without any *Inſtitution* or *Induction*, and without any Examination by the *Ordinary*. But the Clerk is obliged to ſubſcribe the *Declarations*, and to take the *Oaths* enjoined by 14. *C.* 2. and 1. *W.* and *M.* the former before the Biſhop in whoſe Dioceſe the Donative lies, and the latter before the Patron, ſaith *Watſon*. And if it be a Benefice with Cure, he is alſo bound to ſubſcribe the Thirty-nine Articles before the Biſhop, to read the *Common-Prayer*, and to make the ſame Declaration as other Incumbents do.

BENEFICIO *primo Eccleſiaſtico habendo*, is a Writ directed from the King or Queen to the Chancellor or Lord-Keeper, to beſtow the Benefit that firſt ſhall fall in the King or Queen's Gift, above or under ſuch a Value, on this or that particular Man.

BENEFICIUM *Cedendarum Actionum*, [in *Law*,] is the Right which one Security has, who is ſued for the whole Debt, to force the Creditors by Exception to aſſign over his Action againſt the reſt of his Sureties, or elſe he ſhall not force that one to pay the Debt. *L.*

BENEFICIUM *Diviſionis*, [in the *Civil Law*,] is a Right by which the Creditor ſhall be forced, by Way of Exception, to ſue each Surety for their Share and Proportion, eſpecially when the reſt of the Sureties are under the Juriſdiction of the ſame Judge, and able to pay. *L.*

BENEFICIUM *Ordinis ſive Excuſſionis*, [in the *Civil Law*,] is a Right by which the Surety can, by Way of Exception, force the Creditor to ſue the principal Debtor, before he ſhall recover againſt him as the Surety, except the Surety was given judicially in a Cauſe depending.

BENEVOLENTIA *Regis habenda*, the Form in ancient Fines and Submiſſions to purchaſe the King's Pardon and Favour, in order to be reſtored to Eſtate, Title, or Office.

BENIGN *Diſeaſes*, are thoſe which are not attended with *anomalous* and extremely violent Symptoms

BERENICE's *Hair*, [*Aſtronomy*,] a Conſtellation called *Coma Berenices*, in the Northern Hemiſphere, conſiſting of Stars near the *Lyon's Tail*.

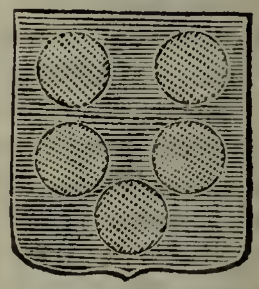
BERME, (in *Fortification*) is a little Space of Ground, three, four, or five Foot wide, left without, between the Foot of the *Rampart* and the Side of the *Moat*, to receive the Earth that rolls down from thence, and to prevent its falling into the *Moat*. Sometimes for more Security the *Berme* is *palliſado'd*.

BERTYING *a Ship*, by ſome is meant the raiſing of a Ship's Sides.

BESAILE, (in *Law*,) is a Writ that lies for the Heir, where his Great Grand-father was ſeized the Day that he died, or died ſeized of Lands in Fee-ſimple, and a Stranger enters the Day of the Death of the Great Grand-father, or abates after his Death, his Heir ſhall have a Writ againſt ſuch a Diſſeiſor or Abater.

BEVEL, an Inſtrument well known to Builders, Carpenters, and Bricklayers, and uſed in adjuſting of Angles.

BEVILE, (a Term in *Heraldry*,) ſignifying *broken*, or opening like a *Carpenter's* Rule. Thus he beareth *Argent* a *chief Bevile vert*, by the Name of *Beverlis*.



BEZANTS, or *Beſants*, (a Term in *Heraldry*) for round Plates of Gold without any Stamp, which are borne frequently in Coats of Arms. *Guillim* ſays, a *Beſant* or *Beſaunt* is taken for a maſſy Plate of Gold of 101 *lib.* and 2 Ounces Wt. though ſome think they were ſmaller Pieces ſtamped at *Bizantium*, or *Conſtantinople*: Whence the Name.

BEZOAR *Animale*, according to ſome, is the Liver and Heart of Vipers dried and powdered.

BEZOAR *Minerale*, is an Evaporation of the Solution of Butter of Antimony in Spirit of Nitre, till a white Maſs remain at the Bottom: On this new Spirit of Nitre is poured, and the Liquor evaporated again; and this is a third Time repeated; then the Matter is calcin'd for about half an Hour, which will turn it into a white Powder fit for Uſe.

Mr. *Boyle* calls it *Bezoardicum minerale*.

BEZOARDICUM, or *Bezoardick Remedies*, or *Cordial*, are ſuch as are endued with a Vertue to reſiſt and expel Poiſon and Malignity.

BEZOARDICUM *Joviale*, is a *Regulus* made by melting three Ounces of *Regulus* of Antimony with two Ounces of Block-Tin, which being powdered, is mixed with ſix Ounces of ſublimate Corroſive, and then is diſtilled off in a Kind of Butter; which Butter is afterwards diſſolved in Spirit of Nitre, (of thrice its Weight) and then the Solution is diſtilled three times. The *Bezoar* will remain at the Bottom, which muſt be powdered and waſhed, and then mingled with Spirit of Wine, and digeſted till is grow inſipid.

BEZOARDICUM *Lunale*, is made by mixing eight Ounces of rectify'd Butter of Antimony with an Ounce of fine Silver, and then diſſolved in Spirit of Nitre, which muſt be poured on gently, freſh and freſh, till all the Ebullitions are over, then the Spirit is drawn off from the Matter with a gentle Heat (with three Rectifications) and then the *Bezoar* is managed like the *Jovial Bezoar*; which ſee.

BEZOARDICUM *Martiale*, is a Diſſolution of *Crocus Martis* made by Reverberation (or at leaſt as much of it as can be effected) in Butter of Antimony; and then Spirit of Nitre is poured on it, and they proceed as in the other *Bezoardick Preparations*.

BIANGULOUS, *Biangulus*, *L.* having two Corners.

BIBITORY *Muſcle*, is by ſome ſaid to be that Muſcle that drawn down the Eye towards the Cup when we drink.

BICEPS, is a Muſcle of the Cubit, ſo called, becauſe it hath two Heads or Beginnings; the firſt, or outmoſt, ariſes with a long round Tendon from the upper Part of the Brink of the *Acetabulum Scapulæ*, and runs under the Ligament of the Articulation in a *Sulcus* or Channel on the Head of the Shoulder-bone, where it is incloſed by a proper Ligament. In its Deſcent it begins to grow fleſhy as it marcheth under the Termination of the Pectoral Muſcle, where dilating itſelf into a large fleſhy Body, in-joyns with its other Head or Beginning. The latter ariſeth with a ſomewhat broad, flat and long Tendon at the Extremity of the *Proceſſus Caracoides Scapulæ*; in its Deſcent it ſtrictly adheres to the *Coracobrachialis*, (wherefore ſome Authors not rightly deſcribing that Muſcle amongſt thoſe of the Arm, have miſtaken it for a fleſhy Beginning of this.) But then parting from it, both theſe Heads compoſe a large fleſhy Belly, which becoming tendinous near the Cubit, is commonly ſaid to be inſerted by a ſtrong round Tendon to the Tubercle at the upper Head of the *Radius*. But we, ſays *Cowper*, have obſerved this Tendon to be double, the external of which being thin, paſſeth obliquely over the *Muſculus Pronator Radii Teres*, and Membrane-like, expanding it ſelf, joins with the *Membrana Communis Muſculorum*, which embraceth all the external Muſcles of the *Carpus* and Fingers: When this Muſcle acteth, the Cubit is bended.

BICEPS, a Muſcle of the Leg, called ſometimes *Biceps Femoris*, to diſtinguiſh it from the *Biceps Cubiti*. It hath two Heads, the ſuperior and longeſt of which ariſeth with a round Tendon from the Protuberance of the *Iſchium*; in its Deſcent it becomes large and fleſhy, and in above half its Progreſs leſſens itſelf again, where it is joyned with its other Head, having a broad, partly tendinous and partly fleſhy beginning from the *Linea Aſpera* of the *Os Femoris*, immediately below the Termination of the *Glutæus maximus*; it being thus united, grows tendinous as it marcheth in a Channel on the external Appendix of the *Os Femoris*, becoming perfectly tendinous at its Implantation to the ſuperior Epiphyſis of the *Fibula*. Its Uſe is to help bend the *Tibia*; it is likewiſe employed in turning the Leg, together with the Foot and Toes, outwards, when we ſit with the Knees bended.

BICIPITAL, of *Biceps*, having two Heads.

BIENNIAL, *Biennis*, *L.* of two Years Continuance.

BIFARIOUS, *Bifarius*, *L.* that may be taken two Ways, two fold.

BIGAMY, ſignifies either thoſe that were married more than once, which was formerly an Impediment that hindred a Man from being a Clerk; or as uſed in Common Law, to have more than one Wife at the ſame Time.

BIGHT, or *Bite*, is any Turn or Part of a Rope that lies compaſſing; and therefore when they cannot take the End of a Rope in Hand, the Seamen ſay, *Give me a bite*.

BILANCIIS *deferendis*, is a Writ directed to a Corporation for the carrying of Weights to ſuch a Haven, there to weigh the Wooll that ſuch a Man is licenſed to tranſport,

BILARIUS *Ductus*, (*Anatomy*,) a Channel with which the *Ductus Cyſticus* makes the *Ductus communis Choledochus*, which paſſes obliquely to the lower End of the Gut *Duodenum*, or the beginning of the *Jejunum*. It is alſo called *Ductus hepaticus*, *L.*

BILDGE *of a Ship*, is the bottom of her Floor. *Bildge Water* therefore is that which by Reaſon of the Flatneſs of a Ship's Bottom lies on her Floor, and cannot go to the Well of the Pump; and conſequently the *Dutch*, whoſe Ships are often of this Form, do much uſe a ſort of Pumps called *Bildge Pumps*, or, as we call them *Burr-Pumps*, to carry off this *Bildge Water*: Alſo when a Ship ſtrikes on a Rock, they ſay *ſhe is bilged*. And *Billage* is the Breadth of her Floor when ſhe lies aground.

BILE, or the *Gall*, is a Liquor partly ſulphureous, and partly ſaline, which is ſeparated from the Blood of Animals in the Liver; for the receiving and evacuating of which, there have been reckoned only two Veſſels or Paſſages, that is, the *Gall-bladder*, and the *Porus bilarius*. By this latter there flows a thicker but milder; by the former a thinner, and more acrimonious and fermentative Choler into the Inteſtine; but beſides theſe, there has been lately found out a Third, which we ſhall deſcribe by and by.

The *Gall-bladder*, called in *Greek* κύστις χοληδόχος, in *Latin*, *Veſica bilaria*, or *Folliculus fellis*, is a hollow Bag placed in the under or hollow ſide of the Liver, and in Figure repreſenteth a Pear. It is about two Inches in length, and one in breadth where broadeſt.

By its upper Part it adheres to the Liver, which doth afford it a Hollowneſs to lodge in; but the lower Part, which hangeth without the Liver, reſteth upon the Right-ſide of the Stomach and the *Colon*, and doth often dye them both yellow.

It hath three Membranes, one *common*, which is thin and outmoſt. This ſpringing from the Membrane of the Liver, only covereth that Part which hangeth without the Liver. The two other Membranes are *proper*. The Middle is thick and ſtrong, and muſcular, and hath three Ranks of Fibres; the outermoſt are tranſverſe, the middle oblique, and the innermoſt ſtrait; but ſome will allow only two Ranks, *viz.* the *ſtrait*, which run lengthways of it, and are outer; and the *tranſverſe* or *annular*, which are the inner.

The inmoſt Coat is nervous, or tendinous as it were; and to the Inſide of this there adhereth a kind of glandulous Coat. The Glands herein do ſeparate from the Arteries a kind of mucous Humour, which ſerves to defend the *Veſica* from being irritated by the Acrimony of the Choler contained in it.

Beſides theſe two *proper* ones, *Verheyen* affirms there is a third, betwixt that I called *common*, and the middle, and ſays, it is ſo evident, that he wonders this quick-ſighted Age has not yet diſcovered it. It is interwoven with whitiſh Fibres drawn diverſly and irregularly, and has abundance of Nerves and ſanguiferous Veſſels running through it, whoſe chief Branches run moſtly from its Neck towards its Bottom; and upon this Account this Coat may be termed *vaſcular*. In fat People it contains much Fat, and with a little Labour is ſeparated into divers Flakes (or Plates.)

It hath two Parts, the *Bottom* and the *Neck*.

The *Bottom* is its larger or wider Part that contains the Choler, and is of the ſame Colour with the Bile that is in it; whence it commonly looks yellow, but ſometimes greeniſh, blackiſh, &c.

The *Neck* (otherwiſe called *Meatus Cyſticus*) is its narrower Part, being but about as wide as a Gooſe Quill, and about two Inches long. Betwixt this and the *Veſica* there is a certain fibrous Ring, which much ſtraitens the Paſſage, and ſo hinders the too haſty Repletion of the *Veſica.* The other End of the Neck is joined to the *Porus bilarius*, and they both make the *Ductus communis*, or common Paſſage of the Choler, which is inſerted into the Beginning of the *Jejunum*, or the End of the *Duodenum.* *Peucerus* has obſerved, that in many Birds, and ſome Fiſhes, this *Meatus* does not join the *Porus bilarius*, but is inſerted ſeparately into the Guts.

The Ancients, whoſe Opinion is of late ſtiffly defended by Dr. *Cole*, thought that the Choler in the *Gall bladder* was received in by its Neck from the *Porus bilarius*, and that it paſſed out into the common Duct the ſame Way. And to obviate the Objection, that there uſes not to be a Reciprocation of Humours in the ſame Veſſel (at the ſame time eſpecially,) Dr. *Cole* ſuppoſes, that the Gall paſſes out of the *Gall-bladder* only in the Time of the Diſtribution of the Chyle, but at all other Times it is received into it from the *Porus*, and is ſtored up in it againſt the next Occaſion. But not to enter into this Diſpute, I think Dr. *Glyſſon*'s Account of it the more probable, which is this: The ordinary Way of filling the *Gall-bladder*, is by its fibrous Roots that are diſperſed through the Liver. The whole Trunk of theſe Roots enters that Part of the Bladder where it is ſtraitened by a fibrous Ring. This Trunk indeed hardly equals the Hundredth Part of the Roots of the *Porus bilarius*; yet it diſtributes ſome Twigs and capillary Veſſels into the hollow Side of the Liver. But if you open the *Gall-bladder* with a Deſign to underſtand the Manner of the Inſertion of this Trunk into it, truly you will not eaſily find it. For tho' this Duct do penetrate the ſaid Bladder, and the Humour contained in it be diſcharged thereinto; yet there is hardly any Print or Sign of this Hole in the Inſide of the Bladder: Which ought not to ſeem hard to be believed by any one, if he remember the Inſertion of the Ureters into the *Veſica*; for though theſe do far exceed this Trunk in Width, yet one can hardly find their Inſertion, if he cut open the Bladder and look for it. The beſt Way (that I could yet find) to diſcover the Inſertion of this Trunk (if you will open the *Gall-bladder*, and ſearch for its Entrance into it) is thus: Look carefully for a certain little and ſpongy Protuberance near the Orifice of the Bladder hard by the *Meatus Cyſticus*; for the aforeſaid Trunk, I think, is pretty plainly inſerted into that Protuberance.

This Protuberance is called a Valve by *Spigetius.*

Beſides this, Mr. *Perault* has found out another *new Conduit* for the Bile, which he calls *Ductus cyſt-hepaticus*, becauſe it is common both to the *Veſicula* and the *Porus hepaticus* (or *bilarius.*) This Duct has three Roots, which being ſubdivided into numerous Twigs, are diſperſed through the *Parenchyma* of the Liver, amongſt the Branches of the *Vena Cava* and *Porta*: Theſe Roots grow into one Trunk, which creeping along the Surface of the hollow Side of the Liver, has a double Implantation; one into the *Porus bilarius*, two Inches and an half before the ſaid *Porus*'s uniting with the *Meatus cyſticus*; and another into the Middle of the *Veſica*, (on that Side of it which adheres to the Liver) with a Valve. This Valve ſeems to be formed of the inner Membrane of the *Veſica*, and alſo a proper one, and may be ſaid to be a Kind of Middle Valve, between the Nature of the *Sigmoides* and *Triglottis* (or *Tricuſpis*) of the *Vena arterioſa* and *Arteria venoſa* in the Heart. Betwixt its Inſertion into the *Porus bilarius*, and this into the *Veſica*, there is about ſix Inches Length. It contains a thinner Choler in it than the *Porus bilarius.*

Jo. Alp. Borallus, Profeſſor of the Mathematicks at *Naples*, from the continual and ſpeedy Efflux of the Bile by the *Ductus communis* into the *Duodenum*, believes, that there is a particular Circulation of it: For he affirms, That in a Day's time, from a Perſon faſting, there paſs thirty four Pound of bilious Juice into the *Duodenum* by the common *Duct*, whereas the whole Maſs of Gall is not two Pound: Whence he concludes, that ſo great a Quantity of Gall cannot be produced in the Liver by Way of Fermentation, but that it is ſeparated mechanically, without the Help of any Ferment, only by *Cribration*, from the minute Veſſels of the *Porta* through the Pores of the Glandules of the Liver, as the Urine is ſeparated in the Kidneys; ſo he infers, that there is a particular Circulation of the *Bilis* through the *Abdomen*, performed by the *Venæ Meſariacæ* into the Trunk of the *Porta*, thence to the Liver, thence through the bilious Veſſels into the *Duodenum*, to return again by the Meſaraick Veins. He that would enquire more into this Novel, and (to me) improbable Opinion, may conſult his *Opus poſthumum (pars altera) de Motu Animalium.*

It has been taught by ſeveral Anatomiſts, That its Neck or *Meatus* has ſometimes two, ſometimes three Valves, to hinder the Recourſe of the Choler; but *Diemerbroeck* profeſſes he could never find any, but only that the Egreſs of the *Veſica* was very ſtrait, and its Neck wrinkled. Dr. *Gliſſon* declares alſo, that he has opened very many Veſſels of this Kind, and never yet ſaw a Valve in any of them: But he thinks that the fibrous Ring (abovementioned) did impoſe upon thoſe who have thought there was a Valve. Beſides, upon Tryal he has often found, that the Bile by a light Compreſſion of the Fingers, has fluctuated to and again out of the *Cyſtis* into the *Meatus*, and on the contrary; as alſo out of the *Meatus* into the *Ductus communis*, and back again: Which certainly could not be, if there was any Valve in the Way, for that would hinder the one or other of theſe Motions.

The *Veſica Fellea* hath two Veins called *Cyſticæ Gemellæ*, which ſpring from the *Porta.* It hath Twigs of Arteries proceeding from the Right Branch of the *Cæliaca*; and it hath a ſmall thread-like Sprig of a Nerve from the meſenterical Branch of the Intercoſtal.

Many times Stones are found in it, which are lighter and more ſpongy than thoſe of the Urinary Bladder, and will ſwim above Water, which theſe latter will not do.

The other Paſſage which carries the thicker Sort of Choler, is called *Porus bilarius*, or *Meatus hepaticus*, becauſe it paſſes directly from the Liver to the *Ductus communis.*

Within the Liver, its Trunk and Branches are inveſted with a double Coat; its *proper* one, which it retains without the Liver alſo, and another that is *common* to it with the *Porta*, called *Capſula communis*, which it has from the Membrane of the Liver. In this common Coat this *Porus* and the *Porta* are ſo cloſely enwrapped, that you would take them but for one Veſſel, till you hold it either up to the Light (which will diſcover Veſſels of two Colours in it) or very dexterouſly rip up the *Capſula*, and ſo lay them open. Its Roots within the Liver are equally divided with thoſe of the *Porta* every where, ſaving that little Space where the Roots of the *Veſica* are ſpread in the ſinuous and Right-ſide of the Liver. So that having ſpoken above of the Diviſions of the Roots of the *Porta*, I ſhall only obſerve, that they are far larger and more numerous than thoſe of the *Veſica*, drawing Choler from all the Parts of the Liver (ſaving whither the Roots of the Bladder reach) and that more thick and viſcous, yet leſs acrimonious.

This *Porus* ſeems to be a more neceſſary Part than the *Veſica*; for many Creatures, as Harts, Fallow-Deer, the Sea-Calf, *&c.* and thoſe which have a whole Hoof, as an Horſe, *&c.* have no *Gall-bladder*, but there is none that is deſtitute of this.

Without the Liver it is as wide again as the *Meatus cyſticus*, with which it is joined at two Inches Diſtance from the Liver, and both make the *Ductus communis choledochus*.

It has no Valve in its whole Progreſs; only the *Ductus communis*, where it enters the Inteſtine, having pierc'd the outer Coat, paſſes betwixt that and the middlemoſt about the 12th Part of an Inch, and at laſt opens with a round Mouth into the Inteſtine: So that this oblique Inſertion (as that of the Ureter into the urinary Bladder) ſerves inſtead of a Valve, to hinder any thing from regurgitating out of the Gut into this Duct, eſpecially the inmoſt Tunicle of the Inteſtine hanging ſo flaggy before its Mouth, that when any thing would enter in, it claps cloſe upon it and ſtops it.

As to any *Anaſtomoſes* of the Roots of any of theſe biliary Veſſels, with thoſe of the *Vena Porta*, ſuch indeed have been much talk'd of, but without Truth. For their extreme Twigs or Capillaries terminate in the *Parenchyma* of the Liver, out of whoſe Grape-ſtone-like Glandules they imbibe the Choler there ſeparated from the Blood; as is the Caſe of the Capillaries of the *Cava*, for they receive the Blood itſelf imported by the *Porta*, in like Manner, without any Inoſculations.

The Uſe of all theſe *Veſſels* may ſufficiently be learned by what has already been ſaid of them; though ſome are of Opinion, that not only Choler, but other ſuperfluous Humours, are evacuated by them, eſpecially upon taking a Purge.

The Ancients look'd upon the *Bile* as a meer Excrement, or or leaſt to be of no other Uſe, than by its Acrimony to promote the Excretion of the Guts: Which Opinion continued as long as the Liver was thought to be the *Vas ſanguificans*. But when once that *Viſcus* was diſcovered to have ſcarce any other Office than to ſeparate the Choler from the Blood, it hath ſeemed unreaſonable to ſuppoſe ſo large a Bowel was made only for the Separation of a meer Excrement; and therefore it is now generally believed, that the *Bile* is the proper Ferment for both the Chyle and the Blood. A very good Account of the Manner of which *Diemerbroeck* gives us, as follows: The Blood flowing into the Liver by the *Porta*, out of the Gaſtrick and Meſaraick Veins (and, it may be, a little by the Hepatick Artery) is mixed with an acrimonious, ſaltiſh, and ſubacid Juice (made in the Spleen, of the arterious Blood flowing thither by the Arteries, and of the animal Spirits by the Nerves) which is brought into the *Porta* by the *Ramus ſplenicus*. Now both theſe being entred the Liver by the Branches of the *Porta*, by Means of this ſaid acrimonious and acid Juice, and the ſpecifick Virtue or Coction of the Liver, the ſpirituous Particles, both Sulphureous and Salt, lying hid in the ſaid venous Blood, are diſſolved, attenuated, and become alſo a little acrimonious and fermenting; a certain thinneſt Part whereof, like moſt clear Water, being ſeparated from the thicker Maſs of Blood by Means of the conglomerated Glands, placed moſtly in the hollow Side of the Liver, is carried from thence by many Lympheducts, as has been ſaid. But the fermentaceous Spirits of greater Acrimony, mixed with the thicker and more viſcid ſulphureous Juices (for Sulphur is viſcid) and more ſtrongly boiled, when as through the Clammineſs of the Juices in which they inhere, they cannot enter the conglobated Glands, nor from them the Lympheducts, and yet through their fierce Ebullition are ſeparated from the Blood (as Yeſt from Beer;) theſe fermentaceous Spirits, I ſay, being ſever'd with the Juice, in which they inhere, become bitter, and are called *Bile*; which *Bile* being tranſcolated through the Grape-ſtone-like Glandules in the Roots of the *Porus bilarius*, and of the *Gall-bladder*, paſſes thro' them by the *Ductus communis* into the *Duodenum* or *Jejunum*, where it is preſently mixed with the pancreatick Juice, and both of them with the alimentary Maſs, concocted in the Stomach, and now paſſing down this Way, which it cauſes to ferment. And becauſe at its firſt Entrance it is more acrimonious, and has its Virtue entire, and ſo cauſes the greateſt Ebullition with the pancreatick Juice; hence the milky Juice contained in the Maſs concocted in the Stomach is more readily, and in greateſt Quantity ſeparated in the *Jejunum*, and by innumerable lacteal Veſſels (which are more numerous in this than the other Guts) it is more quickly driven on towards the *Receptaculum Chyli*, and this is the Reaſon that this Gut is always ſo empty. But in the following Guts, becauſe the fermentaceous Spirits are a little pall'd, the Efferveſcency becomes ſlower and leſs efficacious, and the Chyle is more ſlowly ſeparated from the thicker Maſs, and therefore they have fewer *Venæ Lacteæ*. At length, what remains of this fermenting Matter, is mixed with the thicker *Fæces* in the great Guts, where by its Acrimony it irritates them to Excretion.

BILINGUIS, [in *Law*,] is that Jury which paſſes between an *Engliſhman* and an *Alien*; whereof Part ought to be *Engliſhmen*, and Part *Strangers*; this is vulgarly called *Party-Jury*. *L.*

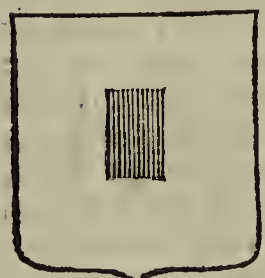
BILL, [*Billa*, *L.*) is all one with an *Obligation*, only when it is in *Engliſh*, it is commonly called a *Bill*, in *Latin*, an *Obligation*. Or a *Bill* is a ſingle Bond without a Condition; and an *Obligation* is a Bond with a Penalty and Condition. Alſo a Declaration in Writing, that expreſſes the Grievance and Wrong which the Complainant has ſuffered by the Party complained of; or elſe ſome Fault committed by him againſt ſome Law or Statute of the Realm.

BILL *of Store*, is a Kind of Licence granted at the Cuſtom-Houſe to Merchants, to carry ſuch Stores and Proviſions as are neceſſary for their Voyages Cuſtom-free.

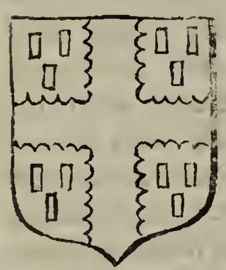
BILL *of Sufferance*, is a Licence granted at the Cuſtom-Houſe to a Merchant, to ſuffer him to Trade from one *Engliſh* Port to another, without paying Cuſtom.

BILLA VERA, [a *Law Term*,] ſignifying the Indorſement of the Grand Inqueſt upon any Preſentment or Indictment which they find to be probably true. *L.*

BILLETS, [in *Heraldry*,] *Guillim* is of Opinion, that they repreſent *Billets doux*; but moſt Authors take them for *Bricks*, and ſay, that many *Engliſh Families* ſettled in *France* bear them, to denote their Extraction from *England*, where ſo many *Bricks* are made: But to this others object, that *England* has never been famous for *Brick-making*, and ſo it might as well ſuit with many other Countries as *England*; but *Columbiere* mentions *Briques* or *Bricks* ſeparate from *Billets*, and ſays, that the Difference betwixt them is, that *Briques* are drawn ſo as to repreſent *Thickneſs*, whereas the *Billets* have only a flat *Superficies*, which plainly intimates, that *Billets* repreſent *Letters* or *Folded Papers*, whether of Love or otherwiſe.

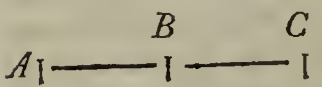


BILLETTY, a Bearing very common in *Heraldry* of this Form. *Argent Billetty, a Croſs engrailed Gules*, by the Name of *Heath*. 'Tis called here *Billetty*, becauſe the *Billets* are ſuppoſed to be all over the Field, but ſometimes they are not above ſix, *&c.* and then they are numbred. *Guillim* ſaith, it repreſents a Letter folded up, and not a Billet of Wood. *Bloom* ſaith, *Billets* muſt be numbred, if not above Ten. *F.*



BILLIONS, [*q. d. Bimillions*, or *twice Millions*,] a Term uſed by *Arithmeticians* in Numeration, intimating that the Word *Millions* is twice mentioned, as 6666666666.

BIMEDIAL, [of *bis*, *twice*, *ſeco*, *to cut*, and *medius*, *L. the Middle*, a Term in *Mathematicks*, if two *Medial Lines*, as *A B* and *B C* commenſurable only in Power, containing a rational Rectangle, are compounded, the whole *A C* ſhall be irrational, and is called a *Firſt Bimedial Line*, 38. *e.* 10. *Euclid.*



BINARY *Arithmetick*, is that in which inſtead of ten Figures in *common Arithmetick*, and the Progreſſion from 10 to 10 only two Figures are uſed, the two Figures are 0 and 1, and the Cypher multiplies every thing by 2, as in *common Arithmetick*, thus 1 is one, 10 two, 11 three, 100 four, *&c.*

BINARY *Number*, one compoſed of two Units.

BINARY *Meaſure*, [in *Muſick*,] is a Meaſure wherein you beat equally, or the Time of Riſing is equal to that of Falling.

BINDING *Joiſts*, [in *Architecture*,] are thoſe Joiſts in any Floor into which the *Trimmers* of the Stair-Caſes and Chimney-Ways are framed: and theſe ſhould be ſtronger than common Joiſts.

BINOCLE, [of *bini*, *two's*, and *Oculi*, *Eyes*,] is a Kind of Dioptrick Teleſcope, fitted ſo with two Tubes joining together in one, as that you may ſee a diſtant Object with both Eyes together.

BINOMIAL *Root*, [*Binominus*, *L.*] in *Mathematicks*, is a Root compoſed of two Parts or Members, and no more, connected together by the Sign $+$: Thus $a + e$, or $5 + 3$ is a *Binomial Root*, conſiſting of the Sum of thoſe two Quantities: If it have three Parts, as $a + b + c$, 'tis called a *Trinomial*, *&c.* if it have four Members, 'tis called a *Quadrinomial*, *&c.*

BIOLYCHNIUM, [of Βίος *Life*, and λύχνιον, *Gr. a Candleſtick*,] is what ſome call the *Vital Flame*, or Life of Animals: See *Flamma vitalis*.

BIOVAC, } in *War*, is a Guard at Night
BIHOVAC, } performed by the whole Army; which either at a Siege, or lying before an Enemy, every Evening draws out from its Tents or Hutts, and continues all Night in Arms before its Lines or Camp, to prevent any Surprize. When the Troops are much haraſſed, or there is no great Dread of the Enemy, the *Biovac* is allowed to be ſufficient if the two Front Ranks by Turns ſtand under Arms, while the Rear Ranks reſt on the Ground. To raiſe the *Biovac*, is to return the Army to their Tents or Hutts at Break of Day.

BIPARTITION, the ſame with *Biſſection*, or dividing a Thing into two equal Parts.

BIPARTIENT *Arithmetick*, a Number which divides another equally into two Parts, leaving no Remainder, as 4 to 8, 6 to 12, 8 to 16, are *Bipartients*.

BIPARTITE, [*bipartitus*, *L.*] divided into two Parts.

BIQUADRATE, a Double Quadrate, or Square.

BIQUADRATE, } [in *Arithmetick* or *Al-*
BIQUADRATICK, } *gebra*,] the fourth Power ariſing from the Multiplication of a ſquare Number or Quantity by itſelf; ſo 9 the Square of 3, being multiplied by itſelf, produces the Biquadrate 81.

BIQUINTILE, an Aſpect of the Planets, when they are 144 Degrees diſtant from each other.

BIRDS, are either *Land-Fowl* or *Water Fowl*: Of *Land-Fowl*, ſome have crooked Beaks and Talons; and of theſe ſome are *carnivorous* and *rapacious*, being called *Birds of Prey*; ſome *frugivorous*, and theſe are called by the general Name of *Parrots*. Of *Birds of Prey* ſome are Diurnal, preying in the Day-time; and of theſe they reckon a greater and leſſer Sort: The greater are either of a more bold and generous Nature, as the *Eagle* Kind; or of a more cowardly and ſluggiſh, as the *Vulture*. The leſſer diurnal *Birds of Prey*, in *Latin* are called *Accipitres*, the *Hawk* Kind; and theſe are either of a more bold and generous Nature, and are wont to be reclaimed and manned for Fowling, and are called *Hawks*; which our *Falconers* diſtinguiſh into Long winged, as the *Falcon*, *Lanner*, *&c.* whoſe Wings reach almoſt as far as the End of their Train; and Short winged, as the *Goſhawk* and *Sparrow Hawk*, whoſe Wings, when cloſed, fall much ſhort of the End of their Train. Thoſe of the *Hawk* Kind, which are of a Nature more cowardly and ſluggiſh, or elſe indocile, are neglected by our *Falconers*, and ſo live at large; and of theſe alſo there is a greater Sort, as the *Buzzard Kind*; and a leſſer, as the *Butcher-bird* or *Shrike* (about as big as a Black-bird, and found in *England*.) The *Bird of Paradiſe*, which is exotick.

Of Birds of Prey with crooked Beaks and Talons, ſome are Nocturnal, as the *Owl* Kind, which fly and prey by Night; and theſe are either horned or eared, as the *Eagle-Owl* and *Horn-Owl*, &c. or without Horns, as the *Brown-Owl*, *Grey-Owl*, *&c.*

There is a Sort of Land Birds with crooked Beak and Talons, which are called *frugivorous*, becauſe though they do ſometime eat Fleſh, and ſo are of the *carnivorous* and *rapacious* Kind, yet they eat *Fruits* too; and theſe are unknown by the general Name of *Parrots*, and are diſtinguiſhed into three Sorts, according to their Bigneſs, the greateſt Size being called *Maccaws*; the middle-ſized, and moſt common, *Parrots* and *Popinjays*, and the leaſt Sort *Parrakeets*; and all this Kind make uſe of their Beak in climbing, and move the upper Jaw.

Land Birds that have their Bill and Claws more ſtrait, are diſtinguiſhed into three Sizes. The greateſt Kind are ſuch as by reaſon of the Bulk of their Bodies, and Smallneſs of their Wings, cannot fly at all; theſe are exotick Birds of a ſingular Nature, ſuch as the *Oſtrich*, the *Caſſowary*, and the *Dodo*. The middle-ſiz'd Kind are divided by their Bills into ſuch as have large, thick, ſtrong, and long ones; ſome of which feed promiſcuouſly on Fleſh, Inſects, and Fruits, as the *Crow* Kind, which are wholly black; and the *Pye* Kind, which are party-coloured: Some feed on Fiſh only, as the *King's-fiſher*; and ſome on Inſects only, as the *Wood-pecker*. And into ſuch as have a ſmaller and a ſhorter Bill, whoſe Fleſh is either white, as the Poultry Kind; or blackiſh, as the *Pidgeon* and *Thruſh* Kind. The leaſt-ſized Kind of Land Birds, with ſtrait Bills and Claws, are called *Small Birds*; and theſe are of two Kinds, *viz.* ſoft beaked, which have ſlender, ſtrait, and pretty longiſh Bills moſt of them, and feed chiefly upon Inſects; or hard baked, which have thick and hard Bills, and feed moſtly upon Seeds.

Water-fowl, are either ſuch as *frequent Waters and watry Places to ſeek their Food*; and theſe are all cloven-footed, and generally have long Legs, and thoſe naked or bare of Feathers for a good Way above the Knees, that they may the more conveniently wade in Waters; of theſe they reckon two Kinds; a *greater*, as the *Crane*, *Jabiru*, &c. and a *leſſer*, which are either *piſcivorous*, feeding on Fiſh, as the *Heron*, *Spoon-bill*, *Stork*, &c. or *Mudſuckers* and *Inſectivorous*; of which ſome have very long Bills, which are ſometimes crooked, as in the *Curlew* and *Whimbrell*; and ſometimes ſtrait, as in the *Woodcock* and *Godwitt*. Others have middle-ſiz'd Bills, as the *Sea-pye* and *Red-ſhank*, &c. and a third Sort have ſhort Bills, as the *Lapwing* and *Plover*. Thoſe are reckoned ſhort Bills which exceed not an Inch and half; middle-ſiz'd are between two Inches and half, and one Inch and half; and long Bills above two Inches and half.

There is another Kind of *Water-fowl* which ſwim in the Water; ſome of which, as the *Moor-hen* and *Coot*, &c. are cloven-footed, but moſt are whole-footed: And of theſe ſome few have very long Legs, as the *Flammant*, the *Avoſetta*, and *Corrira*, (ſee *Willoughby*, *part* 2. *Sect.* 2.) but moſtly they are ſhort legg'd: Of which ſome few have but three Toes on each Foot, as the *Penguin*, *Razor-bill*, &c. but generally they have four Toes on each Foot; and theſe either all connected together by intervening Membranes, as in the *Pelican*, *Soland Gooſe*, &c. or more uſually with the back Toe looſe: And this Kind are either narrow bill'd, or broad bill'd; thoſe with narrow Bills have them either blunt or hooked at the Tip, of which Sort ſome are *ſerrate*, as in the *Diver* Kind; and ſome not *toothed*, as in the *Puffin*; or ſharp pointed or ſtraiter, of which Sort ſome have long Wings, as the *Gull* Kind; and ſome ſhorter, as thoſe Diving Birds called *Douckers*. Thoſe with broad Bills may be divided into the *Gooſe* Kind, which are larger, and the *Duck* Kind, which are ſmaller; and theſe latter into *She Ducks*, or *River* or *Plaſh Ducks*. Moſt Water-fowls have a ſhort Tail; and none of this Kind have their Feet diſpoſed like *Parrots* and *Woodpeckers*, that have two Toes forward and two backward, none having more than one back Toe, and ſome none at all.

BIRTH or *Birthing*; the Seamen call a due or proper Diſtance obſerved between Ships lying at an Anchor or under Sail, a *Birth*; and ſo alſo they do the raiſing or bringing up the Sides of a Ship. Alſo the proper Place Aboard for a Meſs to put their Cheſts, &c. is called the *Birth* of that Meſs. Alſo a convenient Place to Moor a Ship in, is called a *Birth*.

BISHOP, [Biꞅcop, *Sax.* of Eπισκοπος, of επισκοπέω, *Gr. to overlook, or take Care of.*] The whole Proceſs of the Creation of a Biſhop, according to the *Engliſh* Law, is thus: On the Vacancy of any See, the Dean and Chapter are to certify the King thereof in *Chancery*, and to requeſt his Leave to chuſe another Biſhop. The King, when he pleaſes, ſends his *Conge d'Elire*, or Leave to Elect, to the Dean and Chapter, nominating the Perſon whom he thinks fit to have choſen. The Dean and Chapter are obliged, within Twenty Days after the Receipt of this *Conge d'Elire*, to make the Election; which being accepted by the Perſon elected, is certified both to the King and the Archbiſhop of the Province. On this the King grants his Royal Aſſent under the Great Seal, directed to the Archbiſhop, together with a Mandate to confirm and conſecrate him. The Archbiſhop gives a Commiſſion to his Vicar General to proceed to Confirmation, which is a long formal Proceſs, of which the moſt obſervable Parts are two, *viz.* a Citation of all ſuch as have any Objections againſt the Biſhop Elect, to appear before them and offer them; and then a Deduction of all that has paſſed in Relation to the Election and Royal Aſſent; the Particulars whereof are exhibited by the Proctor of the Dean and Chapter to the Vicar General. After this, the Oaths of Supremacy, Simony, and Canonical Obedience, are taken by the Biſhop Elect; on which Sentence is read, and ſubſcribed by the Vicar General, whereby the Election is ratified and decreed to be good. Next to this follows the Conſecration, which is performed by the Archbiſhop and two other Biſhops: Then the Archbiſhop ſends a Mandate to his own Archdeacon, to inſtall the Biſhop in that Cathedral Church which belongs to his See; and this is ofteneſt done by Proxy. And the Publick Notary there preſent, records the whole Proceſs in an authentick Inſtrument to be kept to Poſterity; and after this the new Biſhop is introduced to the King to do Homage. On his Conſecration the Biſhop hath a Right to his Temporalities, but he cannot ſue for them till his Conſecration be certified by the Archbiſhop; but the King may grant the Biſhop his Temporalities immediately after his Confirmation. By his Confirmation he is inſtated in the Juridiction of his Dioceſe, ſo as to excommunicate and certify it; and therefore the Power of the Guardian of the Spiritualities ceaſes from that Time forward. *Clergyman's* Vade Mecum.

BISMUTH, or *Tin Glaſs*, by the Ancients was thought to be a natural *Marcaſite* or Mineral; but *Lemery* ſaith, 'tis a kind of *Regulus* or Tin, and aſſures us, that good *Biſmuth* may be made with *Tin*, *Tartar*, and *Salt-petre*; and ſome mix *Arſenick* alſo with it, for which Reaſon it ought not to be taken inwardly. Its Flowers and Magiſtery are uſed as Coſmeticks; and the Pewterers alſo do uſe *Biſmuth* to render their Work more beautiful, and to make the Metal ring the better.

BIS-SECTION, [a Term in *Geometry*,] ſignifying the Diviſion of any Quantity into two equal Parts or Halves, the ſame with *Bi-partition*. Thus to biſſect any Line, is to divide it into two equal Parts.

BISSEGMENT, [in *Geometry*,] one of the Parts of any Integer divided into two equal Parts.

BISSEXTILE, [of *bis* and *ſextilis*, *L.*] the ſame in Chronology as our Leap-Year; and the Reaſon of the Name is, becauſe in every fourth Year they accounted the 6th Day of the Kalends of *March* twice; for once in four Years, the odd Hours (above 365 Days) made up juſt an whole Day, which was inſerted into the *Kalendar* next after the 24th of *February*. To prevent all Ambiguity which may ariſe on the Account of the Intercalation of a Day every fourth Year, it is appointed by the Statute *de Anno Biſſextili*, 21 *Hen.* 3. that the Day increaſing in the Leap-Year, and that next before, ſhall be accounted but as one Day.

BITE, in the Sea-Phraſe, is the compaſſing or bringing about of a Rope or Cable; the Seamen call holding by that Part of a Rope which is quoiled or rolled up, *holding by the Bite*.

BITTACLE, is a Frame of Timber ſtanding in the Steerage of a Ship juſt before him that ſteereth, and in it is placed the *Compaſs*, by which the Ship is kept in her Courſe, and finds her Way.

BITTER, any Turn of a Cable about the Bitts is called a *Bitter*; and 'tis uſed that the Cable may be let out by little and little. And when a Ship is ſo ſtopp'd by a Cable, they ſay ſhe is *brought up to a Bitter*. Alſo that End of the Cable which is uſed to be wound or belayed about the Bitts, they call the *bitter End of the Cable*.

BITTS, (aboard a Ship) are two great Pieces of Timber, on, or through whom goeth the Croſs Piece, placed uſually abaft the *Manger* in the *Loof* of the Ship, to *belay* (or faſten) the Cable thereto when ſhe is at Anchor: Their lower Ends are faſtened into the *Riders*; and in great Ships their middle Parts are bolted to two great Beams croſs the *Bows*; and yet in great Storms they are fain to faſten the Cable to the Main-maſt, to ſtrengthen the Bitts, and to ſecure the Bows, which are ſometimes elſe torn from the Ships.

There are *Fore Topſail Sheat Bitts*, whoſe Uſe is to belay or faſten the Fore Topſail Sheats.

And there are alſo the *Fore-jeer Bitts*, which ſerve to belay or faſten the Fore-jeer.

BIVALVE, [*Bivalvis*, *L. opening two Ways*,] is a Word uſed by the Writers of *Natural Hiſtory* for both ſuch Shell Fiſhes as have two Shells, as *Cockles*, *Muſcles*, *Oyſters*, &c. which are ſaid to be of the *bivalve* Kind: and alſo for the *Siliqua*, or Seed Pods of ſuch Plants as open all their whole Length to diſcharge their Seeds, ſuch as Beans, Peaſe, &c. for thoſe the Botaniſts ſay have a *bivalve ſiliqua*.

BIVENTER: See *Digaſtricus*.

BLACK-MAIL, ſignifies a certain Sum of Money, (or rather only of) Corn, Cattle, &c. given by the poor People in the North of *England*, to the moſt powerful Perſons in thoſe Parts, or in the Hundreds, for a Protection againſt Thieves and Robbers.

BLACKNESS, the Colour ſo called, ſeems to ariſe from ſuch a peculiar Texture and Situation of the ſuperficial Parts of any black Body, that it doth as it were deaden the Light falling upon it, and reflect none, or very little of it outwards to the Eye. See *Colour*.

BLACKNESS. The incomparable Sir *Iſaac Newton*, in his *Opticks*, ſhews, That for the Production of *black* Colours, the Corpuſcles muſt be leſs than any of thoſe which exhibit other Colours, becauſe at greater Sizes of the component Particles, there is too much Light reflected to conſtitute this Colour; but if they be a little leſs than is requiſite to reflect the White and very faint Blue of the firſt Order: (*Vid. Book* 2. *Obj.* 4. 17 and 18.) they will reflect ſo little Light as to appear intenſely Black, and yet may perhaps reflect it variouſly to and fro within them ſo long, till it happen to be ſtifled and loſt; by which Means they will appear black in all Poſitions of the Eye without any Tranſparency.

And from hence it appears why *Fire*, and that yet more ſubtle Diſſolver *Putrefaction*, by dividing the Particles of Subſtances, turn them black: Why ſmall Quantities of black Subſtances impart their Colour very freely and intenſely to other Subſtances to which they are applied; the minute Particles of theſe, by Reaſon of their very great Number, eaſily over-ſpreading the groſs Particles of others. Hence alſo it appears, why Glaſs ground very elaborately with Sand on a Copper-plate, till it be well poliſhed, makes the Sand, together with what by rubbing is worn off from the Glaſs and Copper, become very black: And why black Subſtances do ſooneſt of all others become hot in the Sun's Light and burn; (which Effect may proceed partly from the Multitude of Refractions in a little Room, and partly from the eaſy Commotions of ſo very ſmall Particles:) And alſo why *Blacks* are uſually a little inclined to a blueiſh Colour; for that they are ſo, may be ſeen by illuminating white Paper by Light reflected from black Subſtances, where the Paper will uſually appear of a blueiſh White: and the Reaſon is, that Black borders on the obſcure Blue of the firſt Order of Colours deſcrib'd in the above-mention'd 18th Obſervation, and therefore reflects more Rays of that Colour than of any other.

'Tis neceſſary alſo to the Production of *Blackneſs* in any Bodies, that the Rays be ſtopt, retain'd, and loſt in them; and theſe conceive Heat (by Means of a burning Glaſs, &c.) more eaſily than other Bodies, becauſe the Light which falls upon them is not reflected outwards, but enters the Bodies, and is often reflected and refracted in them till it be ſtifled and loſt.

BLACK-ROD, is the *Huiſhier* or Uſher belonging to the moſt noble Order of the *Garter*; ſo called from his *Black Rod* which he carries in his Hand: He is alſo of the King's Chamber, and Uſher of the Lords Houſe in Parliament.

BLADDER: See *Veſica*.

BLASS, a Word uſed by *Van Helmont*, as *Blanchard* ſaith, to ſignify the Motion of the Stars, &c.

BLAZONING, [in *Heraldry*,] is diſplaying or expreſſing the Parts of a Coat of Arms in their proper Colours and Metals; for to lay Colour on Colour, or Metal on Metal, is falſe *Heraldry*.

In blazoning a Coat of Arms, you muſt always begin with the *Field*, and then next proceed to the *Charge*; and if there are many things borne in the *Field*, you muſt name firſt that which is immediately lying upon the *Field*. Your Words muſt be very ſhort, and truly proper and expreſſive, without any Expletives, needleſs Particles, or Repetitions. In the Blazon of a Coat of Arms, ſuch Terms for the Colours muſt be uſed as are agreeable to the Station and Quality of the Bearer: All Perſons beneath the Degree of a Noble, muſt have their Coats blazoned by Colours and Metals; Noblemen by precious Stones; and Kings and Princes by Planets.

BLENCH, [in *Law*,] is the Title of a Kind of Tenure of Land; as to hold Land in *Blench*, is by Payment of a Sugar-Loaf, a Bever Hat, a Couple of Capons, and ſuch like; if it be demanded in the Name of *Blench*, i. e. *Nomine Albæ Firmæ*. See *Alba Firma*.

BLINDS, [in *Fortification*,] are certain Pieces of Wood, or Branches of Trees, laid acroſs from one Side of the Trench to the other, to ſuſtain the Bavins or Hurdles laden with Earth; and ſerve to cover the Pioneers from above, and are commonly uſed when the Works are carried on towards the *Glacis*, and when the Trench is extended in Front towards the Place.

BLISTERING *Plaiſters*: See *Veſicatoria*.

BLOCK *and* BLOCK, [*Sea Term*,] a Phraſe uſed when two Blocks meet in haling any Tackle or Halyard, having ſuch Blocks belonging to them.

Fiſh BLOCK *in a Ship*, is a Block hung at a Knot at the End of a *Davit*; the Uſe of it is to hall up the Flooks of an Anchor to a Ship's Bow.

BLOCKADE, [*Blocu*, *F.* probably of *Blochus*, *Germ. a wooden Houſe*, or as others, *Blocal*, *Galliſh*, *a Barricade*; others derive it from *buculare*, *L. to ſhut up the Paſſage*,] in the *Art Military*, is the encompaſſing any Town or Place ſo all round with armed Troops, that it is impoſſible any Kind of Supplies can be brought to it, and ſo it muſt be ſtarved or ſurrender; but there is no Deſign of taking it by Attack, *&c.* And when any Place is in this Condition, 'tis ſaid to be *blockaded*.

BLOCKADING, is when the Beſiegers take Care to ſtop all Ways and Paſſages, and all Intelligence that may be ſent into or out of the Town or Fort that is block'd up, but the Place is not regularly beſieg'd, nor attack'd in Form.

BLOCKS, are the Pieces of Wood a-board a Ship, in which the Shivers are placed, and wherein go the running Ropes. Of theſe Blocks ſome are ſingle, ſome double, and ſome have three, four, or five Shivers in them. They are diſtinguiſhed and named by the Ropes they carry, and the Uſes they ſerve for.

BLOOD, [Blod, *Sax.*] In *Phil. Tranſact. N.* 191. Is an Eſtimate of the Quantity of the Blood in an human Body, and of the Celerity of its Motion by Dr. *Allen Moulin*.

Dr. *Lower* was probably miſtaken when he computed the Quantity of Blood in an ordinary Man to be about twenty Pounds; and the Computation of Dr. *Moulin*, That the Blood is about 1 20th of the Weight of the whole Animal, ſeems much nearer to the Truth; for then an ordinary Man may be ſuppoſed to have about eight or ten Pounds of Blood in him.

Of the Circulation of the Blood, Dr. *Gibſon* gives this Account.

Seeing by a continual Reciprocation of the Pulſe there is a conſtant Expulſion of Blood from the Heart into the Arteries, and as continual an Influx of Blood into it out of the *Cava*; and ſeeing the *Cava*, from whence the Supply is, is never dry; nor, on the other Hand, the Arteries that receive the Blood continually from the Heart, unduly ſwelled with it; it neceſſarily follows, that this Motion proceeds *circularly*, *viz.* that the Blood is continually driven out of the Heart into the Arteries, out of theſe into the Parts to be nouriſhed; from whence it is reſorbed by the capillary Veins, which conduct it back through the larger into the *Cava*, and ſo at length it returns to the Heart again. The Invention of which Circulation is owing to our Countryman Dr. *Harvey*, and may be proved undeniably by theſe Reaſons.

1. From the great Quantity of Blood that is driven out of the Heart into the Arteries at every Pulſe: For though the Ancients who knew not this Circulation, imagined that only a Drop or two was expelled by every *Syſtole*, which they were neceſſitated to ſuppoſe to avoid the great Diſtention that the Arteries muſt be liable to, if any conſiderable Quantity iſſued into them; yet it is certain and demonſtrable, that there muſt needs an Ounce or more be driven into them each Time. For (taking it for granted that there is no other Way for any Liquor to paſs from the Stomach to the Kidnies, but through the Heart along with the Blood) ſeeing, if ſome Men at ſometimes drink three Pints of Drink, they ſhall piſs it out again in half an Hour, yea, more of *Tunbridge* Waters in that Space; and ſeeing *Secondly*, That there is commonly as much Blood as *Serum* that flows to the Kidnies (the Blood returning back by the emulgent Veins) it is clear, that by the two Emulgents (which are none of the largeſt Arteries) there muſt paſs in half an Hour's Time ſix Pound of Liquor, all which muſt come from the Heart; and how much more then may we conceive to be driven through all the other Arteries that run through the whole Body? This is more accurately evinced by Dr. *Lower*'s Experiment, which is this: I cut aſunder (ſays he) both the *Cervical* Arteries in a large Dog, and at the ſame time through an Hole made in the Left Side of his Breaſt over-againſt the Heart, I compreſs'd the Trunk of the *Aorta* below the Heart with my Finger, to hinder any Blood from deſcending by it; and *laſtly*, I took Care alſo to ſtraiten the *Brachial Arteries* under the *Axillæ*, by which Means almoſt all the Blood was driven out of the Heart through the *Cervicals*, (beſides that which was ſent into the *Vertebrals*) and which is wonderful to be related, within the 20th Part of an Hour the whole Maſs iſſued out; ſo that it is not to be denied, but that it all paſs through the Heart in that Space. And though it may be granted, that amidſt ſuch Wounds and Tortures the Heart does beat ſomewhat quicker than at other Times; yet the ſame thing is partly evident from the Wounds in the Limbs when ſome notable Artery is cut aſunder; for it is ſtrange in how ſmall a Time a Man will bleed to Death, even at that one Artery. Yea, we may give a great Gueſs how much Blood is ſent out at every Pulſe, even from the ordinary opening of one Vein in the Arm, from whence a notable Quantity of Blood will iſſue in a ſhort Time; how much may we then ſuppoſe will flow out of all the Veins, if they were

opened at one Time? Seeing then 'tis evident, that ſo great a Quantity of Blood is expelled out of the Heart at every *Syſtole*, and that for all that the Arteries are not unduly diſtended, nor any Part ſwelled by it neither, and yet the *Cava* and other *Veins* emptied, 'tis certain that the Blood that is driven into the Arteries flows back to the Heart by the Veins in a conſtant Circulation.

2. A ſecond Argument to prove it, may be taken from the Valves in the Veins, which are ſo framed, that the Blood may freely flow through them out of the leſſer Veins into the greater (and ſo into the *Cava*) but not, on the contrary, out of the greater into the leſs. Yea, if one blow into the *Cava* through a Pipe, there will no Wind paſs into the ſmaller Veins; but on the contrary, if you blow up the leſſer Veins, the Wind will readily paſs to the larger, and ſo to the *Cava*.

3. And *laſtly*, The ſame thing is more clear by the Ligature in Blood-letting: For whether you let Blood in the Arm or Foot, you always tie the Fillet above where you intend to make the Orifice, and then the Vein below the Ligature will preſently fill and grow tumid, but above it will fall and almoſt diſappear. Which muſt needs be from hence, for that the Blood being driven along the Arteries towards the extreme Parts, returns by the Veins and aſcends upwards, which coming to the Ligature, and being ſtopp'd there, ſwells the Vein below the Ligature, and ſpurts out as ſoon as the Orifice ss made; but when the Fillet is looſened again, the Blood flows no longer out thereat, but holds on in its wonted Channel the Vein, and the Orifice cloſes up again.

Having ſufficiently demonſtrated the Circulation of the Blood, we will ſhew two things farther; *Firſt*, How the Blood paſſes out of the Arteries into the Veins. And, *Secondly*, In how long Time the whole Maſs of Blood may be ſuppoſed to paſs through the Heart in its ordinary Circulation.

As to the *Firſt*, It was the Opinion of *Riolanus*, That the Blood circulated only through the larger Veſſels by *Anaſtomoſis*, or Inoſculation of the Veins with the Arteries; and that that which ran into the ſmaller, was all ſpent on the Nutrition of the Parts. But it is clear, that there muſt be a Circulation even in the ſmalleſt, from the great Quantity of Blood that will flow out of the leaſt Artery in the Hand or Foot when it is cut, which is very abſurd to imagine to be all ſpent on the Nouriſhment of the reſpective Part. Now there are but two Ways whereby the Blood can be ſuppoſed to paſs out of the Arteries into the Veins, *viz. either* by the former's being continued to or opening into the latter by Inoſculation, *or elſe* by the capillary Arteries, letting out their Blood into the Pores of the Subſtance of the Parts, on whoſe Nutrition Part is ſpent, and the Remainder imbibed by the gaping Mouths of the Capillary Veins. That it is neceſſary to admit of this *latter* Way, is evident, becauſe if Part of the Arterial Blood did not iſſue into the Subſtance of the Parts, they could not be nouriſhed by it; for while it is in the Veſſels, it may add Warmth indeed to the Parts through which it flows, but cannot nouriſh them, ſeeing even the Veſſels themſelves are not nouriſhed by that Stream of Blood that glides along their Cavity, but by Capillaries running through their Coats; and if the Blood be driven into the Subſtance of the Parts, and that in a greater Quantity, than ſuffices for their Nouriſhment (as was juſt now ſhewn that it is) what is ſuperfluous muſt needs enter the Mouths of the Capillary Veins, from whence it goes forward to the larger, and ſo to the Heart: But ſeeing this Way of tranſfuſing the Blood thro' the Subſtance of the Parts, has ſeemed to ſome not to anſwer to that haſty Circulation of it we have demonſtrated; they have thought it neceſſary alſo to admit of the former Way, namely, *Anaſtomoſes*, by which the Veins are continued to the Arteries, and that not only in their larger Branches (as that notable one of the Splenick Artery with the Splenick Vein) but alſo in their ſmaller Twigs in the extreme Parts. But we muſt conſider, that in a living Body the ſolid Parts are infinitely more porous and permeable than in a dead; ſo that tho' the Anatomiſts find their Subſtance ſo denſe and cloſe as to make it ſeem almoſt impoſſible, they ſhould permit ſo quick a Paſſage to the Blood through them; yet he ſhould rather believe it, than ſuppoſe ſuch *Anaſtomoſes* as he cannot diſcover (though it were not difficult to find them out if they had any Exiſtence.) For abating that ſingle one of the Splenick Artery with the *Ramus Splenicus* of the *Porta*, and perhaps ſome of the *Arteriæ* with the *Vena pulmonaria* in the Lungs, none of the lateſt moſt accurate Anatomiſts have been able to find out any. And as for that mentioned, it ſeems rather to be of an Artery with an Artery (ſuch as are frequent in ſeveral Parts of the Body, as are alſo of one Vein with another) than of an Artery with a Vein.

And *Secondly*, As to the Space of Time in which the whole Maſs of Blood may ordinarily circulate through the Heart, it is probably much ſhorter than many have imagined; for ſuppoſing that the Heart makes two thouſand Pulſes an Hour, (which is the leaſt Number any ſpeak of, and ſome have told twice as many) and that at every Pulſe there is expelled an Ounce of Blood (which we may well ſuppoſe, ſeeing the Ventricles are wide enough to contain two Ounces, and that it is probable both that they are filled near full in the *Diaſtole*, and that they are near, if not quite emptied by the ſtrong Conſtriction of the Heart in the *Syſtole*) ſeeing the whole Maſs uſually exceeds not four and twenty Pound, it will be circulated ſix or ſeven Times over through the Heart in the Space of an Hour. And by ſo much the oftner, by how much the Blood comes ſhort of the ſuppoſed Quantity, or the Pulſe either naturally, or by a Fever, ſpirituous Liquors, or violent Motion, is rendred more frequent; by which quick Motion the Blood itſelf is kept from Coagulation and Putrefaction, and the Parts are cheriſhed with vital Heat, which Heat of the Parts is much according to the Slowneſs or Rapidneſs of the Circulation. So when we ſit ſtill, and the Pulſe is ſlow or rare, we grow cold; but when upon running or any violent Exerciſe, the Pulſe becomes more frequent and quick, we become hot.

As to the Manner how Blood is made of *Chyle*, and of its Heat and Colour, and whether the Body be nouriſhed by it, the aforeſaid Dr. gives the following Account.

According to Dr. *Harvey*'s Obſervations, there appears in an *Embryo* a *punctum ſaliens*, or red-beating Speck, which is *Blood*, before any the leaſt Lineament of the Heart; ſo that whatever Inſtrument of Sanguification the Heart may appear to be afterwards, it contributes nothing to the making of the firſt Blood; but it ſeems rather to be made for the Blood's Sake, to tranſmit it to all the Parts of the *Embryo* or *Fœtus*, than the Blood to be made by it. But it muſt be confeſſed, that things proceed in the grown *Fœtus* far otherwiſe than they do in the firſt Formation: For the Parts of an *Embrio* are nouriſhed and increaſed before it hath a Stomach to concoct any thing, and yet in a perfect *Fœtus*, none can deny, that the Stomach does concoct and prepare Nouriſhment for it: So it moves before the Brain is formed ſo perfectly as to be able to elaborate animal Spirits; and yet after it is perfected, every one knows that the Brain does elaborate ſuch Spirits, as being ſent into all the Parts of the Body by the Nerves, enables them to move. In like Manner, though there be Blood in the *Embrio* before the Heart be formed, yet after it be perfected, nothing will hinder but it may at leaſt contribute to Sanguination.

We will ſuppoſe then, that as all the other Parts are formed by the *Vis plaſtica*, or generative Faculty of the (firſt) Vegetative and (then) Animal Soul, ſeated in the *Ovum*, and receive their firſt Increaſe by the Aſſimilation of the *Colliquamentum*; but as ſoon as they are perfected, and the *Fœtus* excluded, are nouriſhed by the Blood; ſo the Blood itſelf, as being at firſt made in like Manner, as ſoon as the Veins, Heart and Arteries, are compleated ſo as it cannot circulate by them, may not improperly be ſaid to be nouriſhed by the *Chyle* or Nutritious Juice, the Heart aſſiſting the Aſſimilation of the one into the other. And this is done in this Manner. The *Chyle* aſcending by the *Ductus Thoracicus*, and flowing into the ſubclavian Vein together with the returning Venal Blood, is poured by the *Vena Cava* into the right Auricle, and ſo into the right Ventricle of the Heart in its *Diaſtole* or Relaxation; then by its *Syſtole* or Contraction it is driven out from thence into the Lungs, from whence it aſcends again into the left Auricle firſt, and then into the left Ventricle of the Heart, out of which it is expelled through the *Aorta*, and paſſing along with the Blood through the Arteries of the whole Body, returns again with it by the Veins to the Heart. For it undergoes many Circulations before it can be aſſimilated to the Blood: Which is evident, both becauſe it is the *Chyle* (*but little altered*) that is ſeparated in the *Placenta Uteri* for the Nouriſhment of the *Fœtus*, and in the Breaſts for the Infant to ſuck, in the Form of Milk; and alſo from hence, that if one be let Blood four or five Hours (or later) after a full Meal, there will a great Quantity of the *milky Chyle* itſelf ſwim at Top of the coagulated Blood. But every time the new infuſed *Chyle* paſſes through the Heart with the Blood, the Particles of the one are more intimately mixed with thoſe of the other in its *Ventricles*, and the vital Spirit, and other active Principles of the Blood, work upon the *Chyle*; which being full of Salt, Sulphur and Spirit, as ſoon as its *Compages* are looſened by its Fermentation with the Blood in the *Ventricle* of the Heart, (eſpecially, but alſo in the Arteries) the Principles having obtained the Liberty of Motion, do readily aſſociate themſelves, and are aſſimilated with ſuch Parts of the Blood as are of a like and ſuitable Nature; ſo that at Length all the Maſs of *Chyle* that is capable of being turned into Blood is ſanguified; and what is not, is evacuated by Urine or Stool, or other proper Emunctory.

It is a very difficult Queſtion, By what Means the Blood acquires its *Heat*? In order to the Reſolution whereof, it will be neceſſary to conſider how many Ways a *liquid Body* is capable of being heated; and thoſe (according to Dr. *Willis*) are three:

Firſt, by ſetting it to ſomething that it hot; ſo Water is made hot by being ſet on the Fire, or in the Sun, or a Stove, or by diſſolving Lime in it.

Secondly, When ſaline Corroſives, which are of a contrary Nature, being mixed with one another, or with ſulphureous, act one upon another, and by the great ſtruggling and Agitation of their Particles, do often excite Heat, yea ſometime Smoke and Burning; as when Spirit and Butter of Antimony, or when *Aqua Stygia* and Oil of Turpentine are mix'd together; as alſo when corroſive Liquors eat into *metallick Bodies*, they often grow hot.

Thirdly, (Which is the only Way beſides that a Liquid grows hot) when ſome Humour abounding with Sulphur or much Spirit, is ſet on Fire by holding a Flame to it, and ſo grows hot by Deflagration; as *Brandy*, &c. There are other Ways indeed of *Calefaction*, as *Fermentation*, *Putrefaction*, and *Attrition*, whereby *thicker* or *ſolid Bodies* often grow hot, but in *Liquid* they produce no ſuch Effect. Thus *Leven* becomes (ſomewhat) hot by *Fermentation*, and *Dung*, or wet *Hay* by *Putrefaction*; but neither Way will a *liquid Body* wax hot: For though *Wine*, *Cyder*, &c. ferment ſo much as to burſt the Sides of the Hogſhead, yet they are not actually hot; nor will Blood become ſo, when it is let out of the Body, diſpoſe it how you will in fit Glaſſes to ferment or putrify. Indeed the Blood within the Body is fermented, and is thereby depurated, but it is not heated by ſuch Fermentation, as neither is any other Liquid. Neither does the heating by *Attrition* agree to it; for though ſolid Bodies are heated by being rubb'd one againſt another; yet ſhake and agitate Liquids as much as you will, they ſhall never be the warmer for it. Therefore there are only thoſe three Ways firſt mentioned whereby actual Heat can be produced in any Liquid: Let us ſee to which of them the *Incaleſcence* of the Blood ought to be aſcribed.

Firſt, Both the Ancients and moſt Moderns are of Opinion, that the Blood is heated the firſt Way, *viz.* by the Admotion of ſomething that is hot. Thus the former hath taught, that the *innate Heat*, and the latter, that the *vital Flame* is lodged in the Heart, and heats the Blood as it paſſes through it: But both theſe Opinions fall to the Ground, ſince it is clear, that the Heart is a *clear Muſcle*, and contains no fit Fewel for perpetuating a Flame, or I know not what implanted Heat: For though it muſt be acknowledged, that the Circulation of the Blood depends on the continual Motion of this Bowel, yet the *Heart* derives its Heat wholly from the Blood, and not the Blood its Heat from the *Heart*.

Secondly, This Heat cannot be cauſed in the Blood the ſecond Way, becauſe its Liquor in a natural State is always homogeneous; and though it abound with Salt, yet that is only volatile, mild, and benign. Nor can any one diſcover, either in the *Heart*, or in any other Place, a ſaline or otherwiſe heterogeneous Mineral, by acting whereupon, or corroding whereof, the ſanguineous Liquor ſhould conceive Heat.

Thirdly, As to the third Way, whereby Liquids grow hot, though it ſeem an hard Saying, *that the Blood is accended*; yet ſeeing we can attribute its Incaleſcence to no other Cauſe, why ſhould we not impute it to this? Eſpecially ſeeing the *proper Paſſions of Fire and Flame* agree to the *Life of the Blood*.

For the chief and moſt eſſential Requiſites to continue a Flame, are theſe three: *Firſt*, That a free and continual Acceſs of Air be granted to it as ſoon as it is kindled. *Secondly*, That it enjoy a conſtant ſulphureous *Pabulum* or Fewel. And *Thirdly*, That it be ventilated, whereby as well its fuliginous, as thicker Recrements may be continually amended from it: And ſeeing theſe agree to the *vital Flame*, as well as to the *elementary*, it ſeems very rational to affirm, *that Life itſelf is a Kind of Flame.*

Thus far that learned Author, whom the *Latin* Reader will do well to conſult, diſcourſing farther on this Subject, in his *Exercit. Medico-phyſica de Sang. Incaleſcentia ſive Accenſione.*

Dr. *Henſhaw* thinks, that the Diſſimilitude of Parts between the Chyle and Blood is ſo great, that it becomes immediately the Cauſe of an extraordinary Ebullition upon their Mixture together; which is very much increaſed by the reciprocal Motion of the Lungs, whereby the Blood is wrought almoſt into a Froth or Foam by that Time it gets into the Left Ventricle of the Heart. Which ſudden Exceſs of Heat is not unlike what happens upon the mingling ſeveral Chymical Liquors together, as *Spirit of Wine*, and *Spirit of Turpentine*, and other ſuch like, where the Heat becomes ſo great, that it often endangers the Veſſels they are contained in. He affirms (contrary to Dr. *Willis*, and I think to the Truth) that new Wine, or Muſt, while it ferments, is hot, and that if the Juice newly preſſed out of the Grapes were added to it as it begins to cool, it would again renew its Ebullition, and its Warmth would be continued ſo long, as one ſhould perſiſt to do ſo: In like Manner he thinks it is the Warmth in the Blood continued by the new Affuſion of Chyle, which renews its Fermentation, and conſequently invigorates its Heat.

Diemerbroeck is of Opinion, That the *vital Spirit* (by which he underſtands the moſt ſubtile Part of the Blood) while through its great Volatility it always endeavours to fly away, does continually agitate the other thicker Particles of the Blood, with which it is intangled and detained from Flight, and is diverſly vibrated by them, and beat back; and ſo the whole Maſs being kept in a continual fermentative Motion, there is produced in it an Heat, which in a great Agitation is great, and in a mean, mean, and in a ſmall, ſmall.

I might cite other Opinions concerning the Reaſon of this *Heat*, but they generally fall in with ſome of thoſe mentioned; of which I ſhall not make my ſelf an Umpire, but think that Dr. *Willis* has ſaid enough in his above cited *Exercitation*, to evince that it is not cauſed either of theſe latter Ways, *viz.* by *Fermentation*, or by *Agitation* of the Particles of the Blood in the Manner *Diemerbroeck* deſcribes it; and whether the Accenſion of the Blood be the more probable Reaſon of it, let the Reader judge.

Why the Blood ſhould be of a *red Colour* rather than any other, no ſatisfactory Reaſon (I think) can be given, but the Will of the *Creator*, though ſome attribute it to the Heart, others to the Mixture of ſalt and ſubacid Juices with ſulphureous, becauſe from ſuch a Mixture there reſults a red Colour, as appears in the Diſtillation of *Sal Nitre*, (which contains many ſulphureous Particles in it) or by the pouring Oil of Vitriol upon Conſerve of Roſes, or other thing that is of a paliſh Red (if it contain any thing of Sulphur) for it will be thereby made of a moſt *deep Red.* We will not ſpend time to ſhew in how many Reſpects theſe Inſtances differ from the *Phænomenon* under Conſideration, but ſhall content ourſelves with enquiring from whence the Difference of Colour ariſes between the Venal and Arterial Blood. Every one knows that when Blood is let out of a Vein into a Porringer, the *Coagulum* is of a florid Scarlet Colour in its Surface, but of a dark red from the Superficies to the Bottom, and of ſuch a Colour it appears as it ſtreams out of the Orifice of the Vein. But if an Artery be cut, the Stream then looks of a far brighter Colour, like the Superficies of the Venal Blood when it is coagulated in a Porringer. Now the Arterial Blood receives not this florid Colour in the Heart, but in the Lungs. For if it received it in the Heart, then might the right Ventricle be ſuppoſed to give it as well as the left; but that it does not do ſo, is clear by this Experiment of Dr. *Lower*'s. If you open the *Vena Arterioſa* which receives the Blood out of the right Ventricle, the Blood differs nothing in Colour from the Venal, but its crudled Part looks every whit as black. But if one open the *Arteria Venoſa* as it is entring into the left Ventricle, it has the perfect Colour of Arterial Blood; which ſhews, that as it owes not that Colour to the left Ventricle, any more than to the Right (being not yet arrived at it) ſo it muſt receive that Alteration of Colour in the Lungs, in which the Nitrous Air being diffuſed through all the Particles of the Blood, is intimately mix'd with it, and (if you will) accends it. For if there be any ſuch thing as a *Flamma Vitalis* (properly ſo called) in Animals, though the Blood (or Chyle rather) be to it inſtead of the Oil or other Matter whereon it feeds, yet it oweth the Continuance of its burning to the Air, without the continued Inſpiration of which the Animal cannot live, but inſtantly dies, even as a Candle is preſently extinguiſhed, if you put it in a cloſe Place where the Air cannot come to it, or by ſome Engine be ſuck'd from it. But this by the by; for I muſt confeſs, that (how plauſible ſoever this Opinion may ſeem on other Accounts) this Alteration of the Colour of the Blood by the Air in the Lungs, is no ſufficient Argument to prove any ſuch *Vital Flame*, ſeeing the Arterial Blood being extravaſated, retains its florid Colour, when no doubt, if ever there was any Accenſion, the Flame is entinguiſhed. But this Scarlet Colour is owing meerly to the Mixture of the Particles of the Air with the Blood in the Lungs, from which it tranſpires in a great Meaſure through the Pores of the Skin, while the Blood circulates in the Habit of the Body, out of the Arteries into the Veins, whence the Venous Blood it ſelf, when extravaſated, appears of a Scarlet Dye in its Surface, which is meerly from its being expoſed to the Air; for if one turn the congealed Blood in a Porringer upſide down, the Bottom, which at the Turning is blackiſh, will in a little while turn to a lighter Red.

Though we have confeſſed that the Chyle does circulate through the Body ſeveral Times before it be perfectly aſſimilated to the Blood; yet we do not think that it paſſes into the Nouriſhment of the Parts in Form of the Chyle. And therefore, when ſpeaking of the Nutrition of the *Fœtus* in the Womb, we often mentioned a *Nutritious Juice* (which was Chyle a little alter'd;) we did not call it ſo with reſpect to the ſolid Parts of the *Fœtus*, but to the Blood it ſelf, whoſe *Pabulum* or Nouriſhment it is, as ſoon as the Umbilical Vein is formed, as the Blood is of the Body. For as to the Increaſe of the firſt delineated Parts of an imperfect *Embryo*, that is far different from ordinary Nutrition.

The Blood then conſiſting of Particles of a different Nature, each Particle paſſes into the Nouriſhment of that Part which is of the ſame Nature with it: So the ſalt and ſulphureous Particles being equally mixed, are agglutinated and aſſimilated to the fleſhy or muſculous Parts; the oily and ſulphureous to the Fat, the ſalt and tartareous to the Bones, *&c.* Now this is not done by any Election or Attraction of the Parts, as if they pick'd and chus'd (with a kind of Diſcretion) ſuch Particles of the Blood as are ſuitable to their own Nature, for the Maſs of Blood is equally and indifferently carried to all the Parts: But there is that Diverſity of Figure both in the ſeveral Particles of the Blood, and in the Pores of each Part, that in the Circulation through the Habit of the Body, ſome ſtick in theſe, and others in thoſe, where they are faſtened and united to the Subſtance of the reſpective Parts; and thoſe which through their peculiar Figure are unapt to adhere to one or other, return again to the Veins, and ſo to the Heart, where they receive ſome new Alteration: So that as *the Life of the Fleſh is in the Blood*, according to *Levit.* 17. 11. ſo has it its vital Heat and Nouriſhment from it alſo.

BLOOD, By this ſome underſtand not only the Fluid in the Veins and Arteries, but likewiſe that in the Lympheducts, Nerves, or any other Veſſel of the Body, becauſe they are all Parts of the Blood ſeparated from it by the Force of the Heart, and many of them by the animal Mechaniſm return to it again after Performance of their deſtined Task. And in this Acceptation it is taken in the Calculations of its Quantity in a human Body, and its Velocities, which becauſe it is of the utmoſt Moment to underſtand, we ſhall give it from the beſt Authors.

The Ventricles of the Heart are each capable of receiving an Ounce of Blood or more; and therefore being full in their *Diaſtole*, we may ſuppoſe that they throw out at leaſt one Ounce of Blood each *Syſtole*. The Heart contracts about 4000 Times in an Hour, more or leſs, according to the different Temperaments, Sexes, and Ages; and therefore there paſs through the Heart every Hour 4000 Ounces, or 250 *lib.* Weight of Blood. Now the common Opinion is, that the whole Maſs of Blood does not exceed 25 *lib.* and therefore, according to this Allowance, a Quantity of Blood, equal to the whole Maſs, paſſes thro' the Heart ten times in an Hour; that is, about once every ſix Minutes. If the Heart contracts 80 Times in a Minute, then 25 *lib.* Weight of Blood paſſes through its Ventricles one in five Minutes, or 12 Times in an Hour. Now having the Number of Pulſes in any determinate Time, the Quantity of Blood thrown out at the Left Ventricle of the Heart every Pulſe, and the Diameter of the *Aorta*, it will be eaſy to find with what Degree of Celerity the Blood moves through the *Aorta*. For *the Celerity with which a Fluid runs out at any Orifice, uniformly, and always running in the ſame Quantity, is equal to the Velocity of a Body which deſcribes a Space of the ſame Length with that of a Cylinder, whoſe Baſis is equal to the Orifice, and whoſe Magnitude is equal to the Quantity of Fluid that runs out in the ſame Time.* Now ſuppoſe the Heart contracts 80 Times in a Minute, and that each *Syſtole* throws into the *Aorta* an Ounce of Blood, which is equal in Bulk to 1, 659 Inches, and conſequently 80 Ounces are 132, 72 Inches; the Diameter of the *Aorta* is found to be 0,73 Parts of an Inch, and therefore its Orifice is 0,4187; by which, if 132,72 be divided, the Quotient 316 Inches, or 26 Feet, gives the Length of a Cylinder, or the Space through which the Blood moves in a Minute, ſuppoſing it were conſtantly going out of the Heart with the ſame Velocity: But becauſe of the *Diaſtole* of the Heart, which is at leaſt half the Time of Pulſation, there goes out 80 Ounces in half a Minute, and conſequently the Velocity of Blood is double, as it moves at the Rate of 52 Feet in a Minute. Now, becauſe the Sum of the Secretions of the Branches of an Artery, is always greater than that of the Trunk, the Velocity of the Blood muſt conſtantly decreaſe as the Artery divides into more Branches. The exacteſt Proportion of the Branches to their Trunks, found by meaſuring an Artery of the Thigh, injected with Wax, is as 12387 to 10000; and conſequently, the greateſt Velocity of the Blood will be to the leaſt as 5233 to 1; or the Blood moves 5233 ſlower in ſome capillary Arteries, than it does in the *Aorta*. The Blood is received from the Arteries into the Veins, where it ſtill moves ſlower as it returns to the Heart again. The Arteries are to the Veins as 324 to 441, and conſequently the Blood moves in the Veins above 7116 Times ſlower than it does in the *Aorta*. The further the Blood moves from the Heart, the ſlower it returns; and all the Blood which at the ſame Time is thrown out of the Heart, does not return at the ſame Time to it again, but the Times are directly as the Spaces the Blood runs over before it returns to the Heart again, and reciprocally as the Velocities, and conſequently ſome Parts of the Blood may be ſome Thouſand Times longer in returning to the Heart than others; and there is no Time when all the Blood can be ſaid to have only once circulated: But if there were any ſuch Time, the Quantity of Blood in the Body muſt be firſt determined, which is very difficult to do, and not yet agreed upon by hardly any two Perſons. Bleeding to Death can never give the Eſtimate of its true Quantity, becauſe no Animal can bleed longer than while the great Artery is full, which may be longer or ſhorter, as the wounded Artery is ſmaller or greater; and the *Aorta* muſt always be the firſt Veſſel that empties. The moſt certain Way, in Dr. *Keill*'s Opinion, is, by finding what Proportion the Cavities of the Veſſels, of which the whole Body is compoſed, bear to the Thickneſs of the Coats. This in the Veins and Arteries may be exactly found, but in the other Veſſels we only know the Quantity of Fluid they contain, by carefully evaporating as much as poſſible. Thus the Doctor found the Fluids are to the Veſſels:

In the	Arteries,	as	1, 7	to 1.
	Veins,		15, 6	
	Muſcles,		3, 6	
	Nerves,		3	
	Bones,		1	

the leaſt of which Proportions ſhews the Liquors to be one half the Weight of the Body; and if a Calculation be made of the Proportion of the Blood in the Arteries to their Coats in a Body weighing 162 Pounds, there will be found 100 Pounds of Blood,

BLOOD-WIT, is a Word uſed in Ancient *Charters* of *Liberties*, and ſignifies an *Amerciament* for ſhedding Blood; ſo that whoſoever had it given him in his *Charter*, had the Penalty due for ſhedding Blood granted him.

BLOODY-HAND, is the Apprehenſion of a Treſpaſſer in the Foreſt againſt Veniſon, with his Hands or other Part bloody, though he be not found Chaſing or Hunting. *Manwood*, *Part* 2. *C.* 18.

BLUFF-HEADED ; a Ship is ſaid to be ſo, when ſhe hath but a *ſmall Rake forward on*, and her Stern is ſet up too ſtrait.

BOARD, a Word uſed variouſly at Sea : To go into a Ship, is called *going on board* ; to be within the Ship, is ſaid to be *within Board* ; and to be without the Ship, is ſaid to be *without Board* ; when a Thing is thrown into the Sea, they ſay it is *heaved over-board* ; when it ſlips down by the Ship's Side, they ſay *it ſlips by the Board* ; when two Ships touch one another, they ſay they are *Board and Board* ; that Side of the Ship that is to Windward, they call the *Weather Board* ; when a Ship lies up to Windward, ſometimes upon one Tack, and ſometimes upon another, they ſay *She makes aboard*, or *Boards it up* ; and if ſhe advances much at one Turning or Tack, they ſay *ſhe makes a good Board* ; when they leave Land behind the Ship, they ſay *they leave the Land on Backboard* ; to enter a Ship in a Fight, is called *Boarding of her.*

To fend the BOAT, [*Sea Phraſe*,] is to keep her from daſhing or beating againſt the Rocks, Ships Sides, or Shore.

Free the BOAT, is to caſt Water out of her.

Man the BOAT, is to put the Men into her that are called the *Boat's Gang*.

To ſwift the Boat, is to make faſt a round about the Boat by the Gunwale, and to faſten the Boat-Rope to it, in order to ſtrengthen her to endure her Tow.

To trim a BOAT, is to keep her even.

To wind a BOAT, is to turn her Head about.

BOAT-ROPE, in a Ship, is that Rope by which the Ship Tows her Boat at the Stern.

BOAT-SWAIN, or (as the Seamen call him) *Booſon*, is an Officer a-board a Ship who hath Charge of all her Rigging, Ropes, Cables. Anchors, Sails, Flags, Colours, Pendants, *&c.* He alſo takes Care of the Long-boat, and its Furniture, and ſteers her either by himſelf or his Mate. He calls out the ſeveral Gangs and Companies aboard to the due Execution of their Watches, Works and Spells ; and he is alſo a Kind of Provoſt Marſhal, ſees and puniſhes all Offenders that are ſentenced by the Captain or Court Marſhal of the whole Fleet.

BOCARDO, the Fifth Mood of the Third Figure in Logick, in which the middlemoſt Propoſition is an univerſal Affirmative, the firſt and laſt particular Negatives.

BOCKLAND, was formerly that which we now call Freehold Land, or Land held by *Charters*, or Inſtruments in Writing, and not to be made over to another, either by Sale or Gift, but left entire to the next Heir, an hereditary Eſtate ; and it was by that Name diſtinguiſhed from *Folkland*, which was Copy-hold Land.

BODY. The Chymiſts uſually call that Veſſel which holds the Matter in *Diſtillation* of the Spirit of *Vegetables*, a *Body*. 'Tis called alſo a *Cucurbit*, where ſee its Figure.

BODY, [in *Geometry*,] is that which hath three Dimenſions, *Length*, *Breadth*, and *Thickneſs* ; as a Line is formed by the Motion of a Point, and a Superficies by the Motion of a Line, ſo a Body is formed by the Motion of a Superficies,

BODY, [in *Natural Philoſophy*,] is uſually defined to be a Subſtance impenetrably extended ; or which having *Partes extra Partes*, cannot be in the ſame Place with, or penetrate the Dimenſions of any other Body. And this Property Sir *Iſaac Newton* expreſſes by the Word *Solidity* ; and according to his excellent Philoſophy, the Idea of a Body, is that which is *extended*, *ſolid*, and *moveable*.

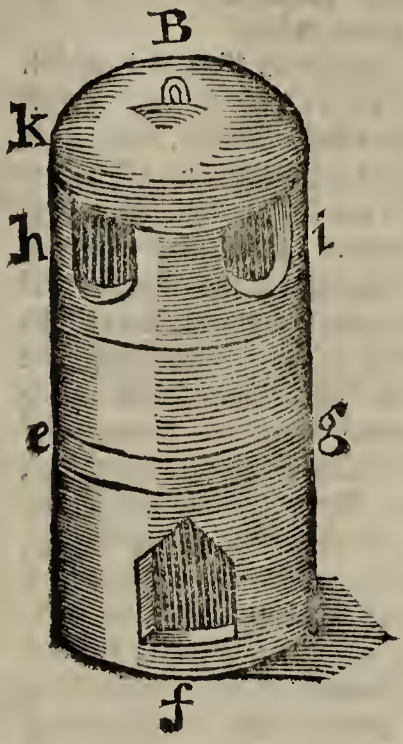
BODIES *Regular* ; ſee *Regular Bodies*.

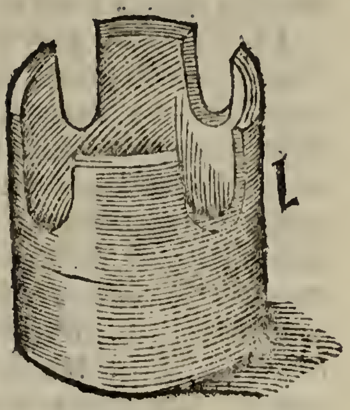
BOILING, *Ebullition*, [in *Phyſicks*,] The Agitation of a Fluid Body, ariſing from the Application of Fire, *&c.* The Phænomenon of *Boiling* may be thus accounted for : The minute Particles of the Fuel being detached from each other, and impelled *in orbem* with a great Velocity (*i. e.* being converted into Fire) paſs the Pores of the containing Veſſel, and mix with the Liquid. By the Reſiſtance they here meet withal, their Motion is deſtroyed ; *i. e.* they communicate it wholly to the *quieſcent Water* ; hence ariſes, at firſt, a ſmall inteſtine Motion in the Water, and from the continued Action of the firſt Cauſe, the Effect is increaſed, and the Motion of the Water continually accelerated ; ſo that the Water by Degrees becomes ſenſibly agitated. But now, the Particles of the Fire ſticking on thoſe in the loweſt Surface of the Water, will not only give them an Impulſe upwards, contrary to the Laws of *Equilibrium*, but will likewiſe render them ſpecifically lighter than before, ſo as to determine them to aſcend according to the Laws of *Equilibrium* ; and this, either by inflating them into little Veſicles, by the *Attraction* of the Particles of Water around them, or by breaking and ſeparating the little Spherules of Water, and ſo increaſing the *Ratio* of their Surface to their *ſolid Content*, there will therefore be a conſtant Flux of Water from the *Bottom* of the Veſſel to the *Top* ; and conſequently, a reciprocal Fluxion from the *Top* to the *Bottom* ; *i. e.* the upper and under Water will change Places ; and hence we have the Reaſon of that *Phænomenon* of the Water being hot at *Top* ſooner than at *Bottom*. Again, an intenſe Heat will diminiſh the ſpecifick Gravity of Water, ſo as not only to make it mount in Water, but alſo in Air ; whence ariſe the *Phænomena* of *Vapour* and *Smoke* : Though the Air incloſed in the Interſtices of the Water muſt be allowed a good Share in this Appearance ; for that Air being dilated, and its Springs ſtrengthened by the Action of the Fire, breaks its *Biſon*, and aſcends thro' the Water into the Air, carrying with it ſome of the contiguous Spherules of Water, ſo many as ſhall hang in its *Villi*, or as can adhere immediately to it. The Particles of Air in the ſeveral Interſtices of the Fluid Maſs thus expanded, and moving upwards, will meet and coaleſce in their Paſſage ; by which Means *great Quantities* of the Water will be heaved up and let fall again alternately, as the Air riſes up, and again paſſes from the Water : For the Air, after Coalition, though it may buoy up a great Heap of Water by its *Elaſticity* while in the Water, yet cannot carry it up together with itſelf into the *Atmoſphere* ; ſince when once got free from the upper Surface of the Water in the Veſſel, it will unbend itſelf in the *Atmoſphere*, and ſo its Spring and Force become juſt equal to that of the common unheated Air. Hence we ſee the Reaſon of the principal *Phænomenon* of *Boiling*, *viz.* the fluctuating of the Surface of the Water.

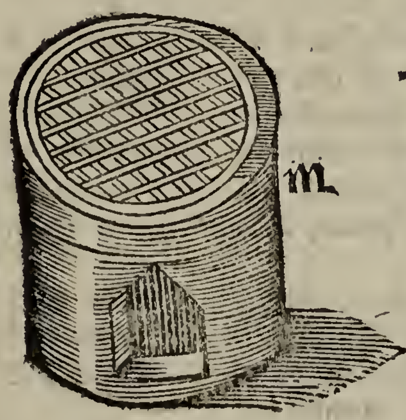
BOLONIAN *Stone*, is a ſmall, grey, weighty, ſoft, ſulphureous Stone, about the Bigneſs of a large Walnut, which being broken, hath a kind of Cryſtal or Sparry Talk within it. It is found about *Bolonia* in *Italy* (whence its Name) and in many other Parts of the ſame Country, and in great Quantity at the Foot of Mount *Palermo*; where a *Shoemaker*, one *Viminzo Coſciarolo*, gathering up theſe Stones, carried ſome of them Home and calcined them, hoping to extract ſome Silver out of them; but inſtead of his Aim, he diſcovered this ſtrange *Phænomenon*, that the Stone, when expoſed to Light, would retain it, and afterwards ſhine in the Dark. After this, though the Stone was much celebrated for its ſhining Quality, yet the Manner of preparing it, to exhibit this *Phænomenon*, was not truly and fully known or diſcovered to the World, till one Mr. *Homberg*, a *German* Phyſician, living at *Paris*, took the Matter into freſh Conſideration, and made a Journey into *Italy* to enquire about the Stone, and its Manner of Calcination; and 'tis he that hath given us the following Proceſs to prepare it; which *Lemmery*, in the laſt Edition of his *Chymiſtry*, *p.* 707. puts down to this Effect.

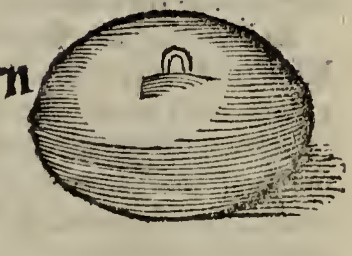
Take ſeven or eight *Bolonian Stones*, and raſp off all their Coat or heterogeneous Earth about them till the Stone begins to gliſter and ſhine; then powder one of them in a brazen *Mortar*, (which Circumſtance is abſolutely neceſſary, for elſe the Stone will not ſhine) and ſift the Powder finely, and moiſtening the other ſeven with clear Brandy very well, roll them up and down in the Powder till their Surface be all covered with it. Then having provided a ſmall Furnace of Earth, round, and about a Foot high, beſides the Dome, and near a Foot and half in Diameter; the Aſh-room muſt have two Doors to give the Fire the more Air, one of them right againſt the other; the Hearth need have none, but only three or four hollow Cuts or Notches (as in the Figure) the Dome ſet on it for reverberating the Fire on the Matter; the Grate ought to be of fine Braſs, or yellow Copper, which helps to render the Stone luminous, and the Holes in it muſt be ſmall.

B, the Furnace all together; *l*, the Hearth of the Furnace ſeparated from the Dome and Aſh-room, that the Hollows or Notches may appear; *m*, the Aſh-room with the Braſs Grate; *n* the Dome by it ſelf with the Ring, to take it on and off.









All Things being thus ready, put into the Furnace five or ſix kindled Coals to heat it, and when they are half waſted, fill the Furnace up to the Holes or Notches with ſmall Cinders, and then lay your Stones covered with the Powder upon them; then cover them with other Cinders that the Furnace may be full: Laſtly, Fix on the Dome, and without touching it any more, let the Coals and Cinders burn to Aſhes. When the Furnace is half cold, ſeparate the Dome, the Hearth, and Aſh-room, and you will find on the Grate the Stones calcin'd: Lay the Grate ſoftly on white Paper, and gathering up the Stones carefully keep them in a Box with *Cotton*.

If theſe Stones be expoſed to the Light, in the open Air, as in one's Hand out of a Window, *&c.* (but not to the Sun-beams) for about a Minute, and then carried into a dark Place, they will for ſome Time appear like kindled Coals, though without any ſenſible Heat; the Light will abate by little and little, but may be recovered a-new by the Stones being again expoſed to the Light of the Day, as before. This ſurpriſing Quality, if well uſed, they will retain for two, three, or four Years; and when 'tis loſt, it may in Part be recovered again by a new Calcination after the ſame Manner.

If you draw any Figures on Paper with the White of an Egg, and while they are wet, ſtrew on them the Cruſt of this calcined Stone powdered; then dry them in the Shade, put them in a Frame, and cover them with a Glaſs: They being expoſed to the Light, with the Glaſs Cover on, will at any Time ſhine if removed into a dark Place.

BOLT-HEAD; ſee *Matraſs*.

BOLT-ROPE, is that Rope into which the Sail of a Ship is fixed or made faſt.

BOLTS, in a Ship, are Iron Pins, of which there are theſe ſeveral Sorts; 1. *Ring-bolts*, which ſerve for the bringing to of the Planks, and thoſe Parts whereto are faſtened the Breeches and Tackles of the Ordnance. 2. *Drive-bolts*, and theſe are uſed to drive out other *Bolts*. 3. *Set-bolts*, which are employed for the forcing of the Planks and the other Works, and bringing them cloſe one unto another. 4. *Rag-bolts*, which are on each Side full of Jaggs or Barbs, to keep them from flying out of the Holes wherein they are driven. 5. *Clench-bolts*, which for the ſame End are clenched, that is, made faſt at the Ends where they come through. 6. *Fore-bolts*, which are made like Locks, with an Eye at each End, whereinto a Fore-lock of Iron is driven to prevent ſtarting out. 7. *Fender-bolts*, made with long and thick Heads, and are ſtruck into the uttermoſt *Bends* or *Wales* of a Ship to ſave her Sides from Bruiſes and Hurts; and thence take their Name.

BOLUS, [Βόλος, *Gr.*] in a *Mineral Senſe*, is a Kind of Earth, and which Dr. *Crew* ſuppoſes to be a Bed, as it were, the *Materia prima* of Opacous Stones and Metals; into which he thinks thoſe of the ſaid *Bolus* are tranſmuted by, being concreted with divers Salts and Sulphurs, which fly in upon them ſucceſſively.

BOLUS, is a Medicine taken inwardly, of a Conſiſtence ſomewhat thicker than Honey, and the Quantity for one Doſe is as much as may be conveniently taken at a Month-full.

BOMB-CHEST, [*Bombe*, *F.*] is a Kind of Cheſt, which being filled with Gun-powder and *Bombs* (according to the intended Execution) is placed under Ground to blow it up into the Air, together with thoſe that ſtand upon. Theſe *Bomb-cheſts* are frequently uſed to drive Enemies from a Poſt they lately ſeized, or whereof they are about to take Poſſeſſion; and are ſet on Fire by the Means of a Saucidge faſtenened at one End.

BOMBS or *Grenado-ſhells*, are hollow Balls of caſt Iron, which are filled with whole Powder, and ſometimes with Nails, Pieces of Iron, *&c.* along with it. Their Uſe is to be ſhot (out of Mortar-pieces) into beſieged Towns, to annoy the Garriſon, fire Magazines, *&c.* The largeſt are about 15, and ſome 18 Inches in Diameter. From theſe Bombs being uſed in the beſieging of Towns, we ſay ſuch a Place was *Bombarded*.

Of Bombs and Grenadoes that are uſually projected from Mortar-Pieces.

If we conſider the greater Sort of *Grenadoes* in Point of Form, we ſhall find them to be of two Kinds, *viz.* Round and Spherical; which laſt we commonly call *Bombs*; though *Boxhornius*, in his Hiſtory of the Siege of *Breda*, calls thoſe alſo *Bombs* that are of a ſpherical Form; for he mentions them in theſe Terms, after having deſcribed the *Hand-Grenadoes*. Bombs *of the largeſt Sizes, that were one or two Foot Diameter, did the ſame Execution; they were ſhot into the Air from Engines, and fell upon the Places they were deſigned for.* But if I am not miſtaken, he here confounds the *Grenadoes* with the *Bombs*; for in another Place he ſays as much of *Grenadoes*, as he does here of *Bombs*, viz. *They were obliged to erect Batteries at various Diſtances from the Counterſcarps, according as the Exigency of Affairs required, either to cover their People, or ſtop the Sallies of the Enemy, to ruin their Machines, demoliſh their Batteries, and diſmount their Cannon. That upon the Batteries they erected, they mounted more or leſs Artillery, with ſome of thoſe Machines* (*meaning* Mortars) *from whence they ſhot* Grenadoes, *which burned and threw down every thing within their Reach.* He then diſtinguiſhes theſe from the *Hand-Grenadoes*, by ſaying, *That the lighter and leſſer Sorts were thrown by the Soldiers.* As an Hiſtorian, I do not diſapprove of what he here ſays, the true Knowledge of theſe Matters being reſerved for *Pyroboliſts*. I ſhall only obſerve, that moſt *Pryotechnicians* call thoſe Balls that are hollow and ſpherical, *Grenadoes*; and that thoſe which are longiſh and oval, they call *Bombs*.

To theſe two are added a third of a Cylindrical Form. It has a firm Tompion beneath, which ſerves to preſs down and confine the Powder in the Chamber of the Mortar, in the ſame Manner as the Tompions, which are commonly uſed on thoſe Occaſions, do. It is not long ſince theſe Grenadoes were put in Execution, for ſome of thoſe who were preſent at the memorable Siege of *Rochelle*, in the Years 1627 and 1628, by *Lewis* XIII. King of *France* and *Navarre*, have related to us the ſtrange Havock they made, and how greatly they annoyed the Beſieged: All which was aſcribed to the great Knowledge and Skill of the worthy *Henry Clarmer* of *Noremberg*, to whom no body can deny one of the firſt Palms, deſervedly beſtowed on the Heroick Warriours, who wrought ſuch Wonders at that remarkable Siege, without doing the leaſt Injuſtice to the Merits of *Pomponius Targon*, who was at that time Chief Engineer to his moſt Chriſtian Majeſty.

But there having been ſome odd-turned Spirits, who have had Impudence enough to rob theſe great Men of the Honour they atchiev'd in the Conduct of ſo long and ſo laborious a Siege, and who have endeavoured (urged by an unaccountable Envy, to aſcribe to themſelves what was due to thoſe illuſtrious Perſons; and they have ſo far gained their Point, as to inſinuate a good Opinion of themſelves into the Credulous and Ignorant, who eſteem them to be in Reality what they only are in Appearance. But a Time will come, when they will receive a Chaſtiſement adequate to their Unworthineſs, for Divine Juſtice leaves no Crime unpuniſhed, and will certainly take Vengeance of them for their fraudulent Dealing, in ſo ungenerouſly aſſuming that to themſelves, which had been purchaſed by others at ſo dear a Rate. But let us return to our Subject, and conſider after what Manner we are to proportion, prepare, and uſe the two firſt Sorts of *Grenadoes*.

There are thoſe who allow the Thickneſs of Metal, for Iron *Grenadoes* and *Bombs*, 1 8th, 1 9th, or 1 10th of their Diameters. The Vent ought to be 2 9ths, as well for theſe as *Hand-Grenadoes*. Near the Vent they have two Ears, or little Handles, by which they are lifted into the Mortars.

The Fuze of the ſaid *Grenado* ſhall be 7 8ths of its Diameter in Length, though ſome *Pyroboliſts* allow it but 6 8ths only. Its Diameter at Top ſhall be 2 9ths or 2 10ths, but beneath it ſhall be but 1 8th only. The Depth of the Concavity in the Fuze ſhall be 1 10th of the ſame Diameter, as uſual. But the whole Myſtery is to know of what Dimenſions to bore the Fuzes; for there is a certain limited Time, at the Period of which the Grenado is to perform its Effect, according to the Diſtances of Places, and according to which the Mortar is elevated to different Degrees of the Quadrant. It is moreover neceſſary to know with what Compoſition they ought to be filled upon different Occaſions, that the Shell may not break till it is very near the Ground; but as this is an improper Place to dwell upon theſe Particulars, which bear an immediate Relation to the artificial Uſe and Conſtruction of our warlike Machines, I ſhall proceed to the Sequel of this Eſſay.

Theſe Fuzes ſhall be reinforced without with dried Sinews ſpread out like Tow, then ſteeped in hot Glue; and within them you ſhall ſtick ſome Threads of *Quick Match* here and there, for Fear the Fuze ſhould unluckily go out, by Violence of the Wind or Air during the Flight of the Bomb: In ſhort, the Fuze being filled with a ſuitable Compoſition, you ſhall drive it into the Vent of the Grenado or Bomb, which muſt be filled with good *Corn Powder*, in the ſame Manner as we directed in Hand Grenadoes.

Obſerve here, That you muſt not uſe a Shell till you have tried whether it be ſound or whole, which you may know by the following Proof; Bury your Shell under burning Coals to make it red-hot, and having acquired that Degree of Heat, take it from under the Fire, and pour cold Water into it before it is cooled, and ſtop up the Vent to prevent the Water getting out; then inſtantly anoint the whole Convexity of the Shell with Butter of *Antimony*, or with Soap moiſtened with a little hot Water; if it is crack'd or defective in any Part, you will ſee little Bubbles or Bliſters, riſe, fall, and diſappear by Turns. If you perceive any thing of this Nature upon the Surface of the Shell, I would have you throw it aſide, if you have any better, as both uſeleſs and dangerous; but if the Situation of your Affairs obliges you to uſe ſuch for Want of better, you ſhall take particular Notice of the Cracks or Flaws, if they are viſible, and if not, you ſhall remark thoſe Places where the Bliſters riſe; or if they are little Holes that are conſpicuous, you may ſtop them with Steel Nails: This done, coat your Shells over with Tar or Pitch, or ſome *Pyrotechnic* Cement, and then cover them well with Tow ſteeped in the ſame Stuff. *Finally*, wrap them tightly round with a ſtrong Cloth. You muſt exactly obſerve theſe Particulars, without omitting the leaſt Thing in the World, for Fear the Grenado ſhould meet with any Accident from the Fire of the Fuze during its Light.

You may find the Requiſite of Powder for projecting your Grenadoes, by what I am now going to ſay: But firſt of all it will be neceſſary for me to tell you, how to come at the Weight of a Grenado, purely by the Aſſiſtance of an *Arithmetical Calculation*, and by Means of our *Calibre Scale*, which is the moſt ready Step towards finding out expeditiouſly and certainly the Quantity of Powder requiſite to ſhoot out your Grenado. This you may work after the following Manner:

Take the Diameter of a Grenado, and apply it to that Side of the *Calibre Scale* which is deſigned for *Iron Bullets*; and conſequently one Foot of the Compaſſes will fall upon a Number anſwering to the Weight of a Grenado if it was ſolid. Set down this Number upon a Piece of Paper, or at leaſt take Care to remember it. Then take the Diameter of the Cavity of the ſame Grenado, and applying in like Manner to the *Calibre Scale*, the Foot of the Compaſſes will point out a Number expreſſing the Weight of that Cavity if it had been ſolid, and of Iron. Then ſubtract the laſt Number from the firſt, and the Remainder will give you the Weight of the Shell of the Grenado.

If you ſhall meet with a Diameter which extends beyond the Length of the *Calibre Scale*, you ſhall apply the Half of it only to the ſaid *Scale*, and the Number it reaches to being multiplied by 8, the Product will give you the Weight of the whole Grenado had it been ſolid. As for Example, Be there given the Diameter of a Grenado that cannot be meaſured by the Extent of the *Calibre Scale*, the Half of which being applied to the ſaid Scale reaches to 18: This Number being multiplied by 8, will produce 144, which would be the Weight of the Grenado had it been ſolid: Then taking half the Diameter of the Hollow or Cavity of it, and applying it to the *Calibre Scale*, ſuppoſe it to extend to 7, let this Number be in like Manner multiplied by 8, and it will produce 56.

In ſhort, this laſt Number being ſubtracted from 144, you will have a Remainder of 88 for the Weight of the Shell of your Grenado or Bomb.

You will find the Quantity of Powder neceſſary to fill your Grenado, if you meaſure the Cavity of it with a certain Line or Scale of Powder, Stereometrically divided into Pounds and Ounces; upon which the Number which falls under the Foot of your Compaſſes, will expreſs the Number of Pounds or Ounces of Powder which the Cavity of the Grenado is able to contain; add now this Weight of Powder to the Remainder of the laſt Subtraction, which gave the Weight of the Shell, and you will have the whole Weight of the Grenado when filled with Powder. I will now inſtruct you in the Conſtruction of this Scale. Fill ſome perfectly round Grenado with Corn Powder up to the Vent, then pour it out again, and weighing it, ſet it down with its Weight. Then meaſure the Cavity of the ſaid Grenado, and divide the Diameter of it Stereometrically into as many Parts as the Powder contains Pounds or Ounces; and upon ſuch a Scale you may mark out the Diameters of ſeveral Pounds or Ounces of a Pound, or half Ounces, if needful.

But if you ſhould not have Grenadoes juſt at Hand, whereby to form this Scale, get an hollow wooden *Cylinder*, of what Size you pleaſe, equal in Weight and Breadth, and filling it with Corn Powder, pour it out again, and weigh it.

Now as every *Cylinder* that contains a Sphere is in a *ſeſquialteral* Proportion to it, according to *Archimedes*, therefore muſt you ſay, As 3 is to 2, ſo is the Weight of the Powder contained in the *Cylinder*, to the Weight of that which would lie held by a Sphere, included in the ſame *Cylinder*. This done, you will have a Number in your Quotient anſwering to the Weight of a Globe of Powder, ſuppoſing the Diameter of ſuch a Globe to be equal to the Height and Breadth of the *Cylinder*: This may be done by any Body that is never ſo little ſkill'd in Geometry.

Sometimes *Pyroboliſts*, by Way of Diverſion or Experiment, fill Grenadoes with Sand, thereby to come the more eaſily at their true Weight: Which done, they put them into Mortars, and taking their Sight at Marks at certain Diſtances, they ſhoot them off, and obſerve their Falls: Upon which Account it is neceſſary to know the Proportion which the Weight of Sand bears to that of Powder. For my Part, I have often experimented, that very fine, white, dry Sand, bears ſuch Proportion to fine Corn Piſtol Powder, as 144 does to 83: Upon this Foundation I have formed another Scale for

Globes of Sand. By which you may know how many Pounds of Sand would fill each Grenado; but if you would take only juſt ſo much Sand as is equal in Weight to the Powder which fills the Grenado, (in which *Pyroboliſts* are very exact) you muſt find out the Quantity required by Means of the proportional Numbers above ; but that *Ratio* will not always obtain, for the Weight both of Powder and of Sand may be infinitely varied ; for as the Ingredients of Gunpowder are mixed a thouſand Ways, you may readily ſuppoſe that it differs much in Weight ; and on the other Hand, the ſeveral Sorts of Sand are infinitely unequal in Point of Gravity : But thoſe who are deſirous of being perfect in our Art, will have the Patience to examine the Gravity of different Sorts of Sand. Having ſhewn you the Way how to come at the Weight of Grenadoes, filled both with Powder and Sand, as I propoſed, without the Help of any Weighing Inſtrument, I ſhall advance farther on.

Now this Weight being found, it will be very eaſy to find the Requiſite of Powder for charging your Mortar. But to ſay the Truth, this is a Point which cannot well be determined ; for *Pyroboliſts* change and vary it very often, as Occaſion requires, being obliged to take more, ſometimes leſs Powder, according to the Diſtances of Places. Moſt commonly they take half an Ounce of Powder for every Pound that the Grenado weighs; and in ſome Caſes they take but a Quarter of an Ounce, and at other Times but 1 8th of an Ounce, and ſometimes leſs, particularly when they would project their Grenadoes ſo as not to be above four or ſix Seconds at moſt before they fall at perhaps the Diſtance of 10 or 15 Paces, and in their Projection borrow more upon a ſtrait Line than a Curve. This is uſually done when the Beſieged ſee the Enemy preparing to make their *Galleries*, or perceive them obſtinately bent upon paſſing the *Foſſe* by any other Means, to gain the Foot of the Rampart ; it is then that the Uſe of Mortars, Grenadoes, and Bombs is not forgot. I muſt own however, that the ſame thing may be done with a greater Quantity of Powder, but then it would be attended with this Inconveniency, namely, that the Grenado being projected with the greater Violence, it would be obliged to go through a greater Space, and conſequently remaining longer in the Air, it would give thoſe who ſee it Time to get out of the Danger of it before it fall. I muſt alſo remark, that you may throw Grenadoes, Bombs, *&c.* at ſeveral Diſtances with one and the ſame Quantity of Powder, by Means of the Elevation of the Piece above the Plane of the Horizon, and alſo by the Declination of it from the Vertical Point or Zenith to an Angle of 45 Degrees, which Poſition is the moſt natural to Mortars. This may not be an improper Hint ; for I am really of Opinion, it would be by much the beſt and moſt certain (were it not for ſome unſurmountable Difficulties and Circumſtances which oppoſe it) to take certain Quantities of Powder in Proportion to each Diſtance ; by which Means the Machines being elevated but a few Degrees above the Horizon, would always have their Poſition very low, which would be never, or very ſeldom changed. However, as this cannot be eaſily practiſed, or indeed not at all, for every Diſtance, yet methinks I would have the great Machines, whoſe Elevation borrow the neareſt upon the Vertical Point, and which are uſually choſen for the ſhorteſt Diſtances, deprived a little of their uſual Requiſite of Powder, and in Recompence for that Loſs, inclined a little more to the Horizon.

But not to ſtop here, and that we may conclude upon ſomething certain with Regard to the Requiſite of Powder, I have eſtabliſhed and aſcertained a Quantity that may, generally ſpeaking, diſlodge the military Projectiles, be their Weight what it will: In Order to this, I have conſtructed a little Table of Requiſites, which I hope may ſucceſſively be put in Practice. I ſay it will be ſufficient, if for Balls or Bombs of great Weight, as 300 *lib.* or more, (if there be any ſuch) you take half an Ounce of Powder for every Pound. This Proportion may be obſerved for Projectiles down to 100 *lib.* But from 100 *lib.* to 1 *lib.* you ſhall increaſe every Quintary, that is, every Fifth Number, with 15 Grains ; ſo that you may have 588 Grains of Powder, which are 2 *Loths* and 12 Grains, to project a Ball of one Pound. Upon this Foundation I have calculated a little *Table* of *Proportion*, from 100 *lib.* down to 1 *lib.* There is nothing can be more plain and eaſy than the Uſe of it ; for you need only multiply the Numbers of the Column *B* by the Numbers of the Column *A*, and divide the Products by 288, in order to have the requiſite Number of *Loths* ; (for a *Loth* juſt contains that Number of Grains :) Which Number of *Loths* being divided by 32, you will have the Pounds. But that you may have a perfect Apprehenſion of this, I ſhall illuſtrate it by an Example. Suppoſe you have a Ball of 80 *lib.* which you would project ; look firſt for 80 in Column *A*, and having found it, multiply it by the oppoſite Number in Column *B*, *viz.* by 348, and you will have a Product of 27840, which will be the Number of Grains of Powder, which being divided by 288, will give 96 *Loths*, 8 *Den.* in the Quotient ; each *Denier* 24 *Grains.* In ſhort, theſe *Loths* being divided by 32, will give 3 *lib.* You muſt then take 3 *lib.* and 8 *Deniers* of Powder to charge the Chamber of the Mortar, from which you would project a Body weighing 80 *lib.*

The following Table will help you in the Difficulties which may occur in this Caſe, provided that you have a right Conception of this Example.

A Table of Requiſites of Gunpowder.

A	*B*
100	288
95	303
90	318
85	333
80	348
75	363
70	378
65	393
60	408
55	423
50	438
45	453
40	468
35	483
30	498
25	513
20	528
15	543
10	558
5	573
1	588

OBSERVATION I.

To every Number between the Quintaries of this *Table*, you ſhall ſucceſſively add three Grains for every Pound. This done, multiply the Sum of that Addition by the Weight of the *Projectile*. As for Example, if you meet with one that weighs 28 *lib.* you will find it leſs by 3 than 85, the ſuperior Quintary of the *Table*, having then added 9, (which is three for each Pound) to 333, you will have 342; this 342 being multiplied by the Weight of the *Projectile*, which is 82, the Product will be 28044; which being divided by 288, you will have 97 *Loths*, 4 *Deniers* and 1 9th.

OBSERVATION II.

The *Rule* here laid down for the *Projectiles* which are ſhot from Mortars, ought to be followed as univerſal and immutable: But at the ſame time Allowance muſt be made for the different Strength of Powder, inſomuch that one Ounce of ſome Sort of Powder, will do twice, nay, ten Times the Service as an equal Quantity of ſome other Sorts; and conſequently, one Ounce of the former will be as ſtrong as ten Ounces of the latter. But I leave this Article to the Conſideration and Judgment of good Practitioners, and ſhall go on to the Loading of our Mortars.

Suppoſe now you have the Requiſite of Powder for projecting a Grenado from a Mortar, you ſhall in the next Place meaſure the Height and Breadth of the Chamber by Means of a *Cylindric Scale*, or rather a *Cylindric-metric Scale*, divided *Cubically*, and adjuſted to the Weight of Gunpowder. Now if it happens that your Chamber is equal in Height and Breadth, you may conclude that it holds as many Pounds of Powder, as the Number it cuts upon your Scale contains Unities: But if on the contrary, its Height and Breadth are different, you muſt find out a mean Proportional between them, which may give you the true Capacity of the Chamber: If theſe Numbers ſhould happen to be Surds, you may find out a mean Proportional between them by Lines much better than by Numbers.

If the Chamber of your Mortar is bigger than neceſſary; firſt put your Powder into the Chamber, and meaſure the Vacancy of it above the Powder: Divide this into ſix equal Parts, and add 1 6th to its Height; and you will have the true Height of a Wooden Tompion; by which the Powder in the Chamber will be ſufficiently compreſſed, ſo that the Flaſh will have no Room to expand itſelf, and will conſequently act with its full expulſive Vigour. But if on the contrary, the Chamber of your Mortar is too little to hold the Requiſite of Powder, divide the Height of it into ten equal Parts, and fill up with Powder to 1 10th, and ram it with a Tompion of 3 10ths. And in this Caſe the Rule we have given above can be of no Uſe.

You muſt proceed after this Manner when it happens that your Powder fills your Chamber ſo exactly as to leave no Room for a Tompion; but you will be better inſtructed in every thing relating to this Matter by the Sequel.

The Wooden Tompions for confining the Powder in the Chambers of Mortars, are prepared after different Faſhions; for if you would fix your Grenado in ſuch a Poſture as to have its Fuze turned outwards towards the Muzzle of the Mortar, and if you would project it by one Fire only, your Tompion ſhould be fluted like a Pillar, or pierced through with Holes at Top which terminate in a large one at Bottom. I muſt here remark, that it is by much the ſafeſt Way to project your Grenadoes by Means of one Fire only; in doing of which you are to obſerve the following Order.

After having Loaded your Chamber with the Requiſite of Powder, and driven the Tompion upon it, ſo as in no Degree to ſurmount the Edge or Rim of the Chamber, you ſhall fill up the Holes in the ſaid Tompion, or the Flutings, with good *Meal Powder*, and ſalt it over with a good Handful of the ſame, then wrap up your Grenado in a Felt, or a coarſe Wollen Cloth well ſoaked in ſtrong Brandy mixed with *Meal Powder*; this Coat or Covering ſhall be open at Bottom, of the ſame Breadth as the Orifice of the Chamber: This done, fix your Grenado in the Mortar in ſuch Manner as to bear upon the Tompion.

The Fuze ſhall be well garniſhed round with ſome of our looſe *Quick Match*, and the whole Body of the Grenado ſhall be well ſalted over with *Meal Powder*, to facilitate the Aſcenſion of the Fuze.

This is the firſt Way of projecting Grenadoes from Mortars with one Fire only. The ſecond does not differ much from it, excepting that it is much the more dangerous of the two; for here the Fuze is turned inwards upon the Chamber, and in this Caſe you muſt have a Tompion with an Hole in the Middle of it, and divided into four equal Parts by Means of two Diameters interſecting each other at Right Angles. However, I would by no Means have this practiſed for ordinary Grenadoes, but I would have them ordered as where the Vent and Bottom are turned into Female Screws, which ſhall have an Iron Fuze with a Screw at Top and Bottom to be inſerted into them. But I muſt tell you, that theſe Screws cannot be too nicely fitted to each other.

If you would rather chuſe to project your Grenado by Means of two Fires, you ſhall have a ſolid Tompion. This Tompion being driven into the Chamber, you ſhall cover it with a freſh green Gazon or Turf, or ſomething of that Kind, which ſhall be covered with a round Board two or three Inches thick, but a little leſs in Diameter than the *Calibre* of the Mortar. To conclude, You ſhall fix your Grenado upon it with its Fuze turned outwards, and cover it with a Gazon; after having ſtuffed the Vacancy between the Shell and the Mortar all round with Hay, Straw, Tow, or Mould, to keep the Shell fixed and firm.

COROLLARY.

To tell you now who firſt invented, or who firſt practiſed this deſtructive Contrivance, which has been promiſcuouſly the Ruin of ſuch Numbers of Men, and the Overthrow of ſo many of the moſt beautiful Buildings, moſt magnificent Cities, and ſtrongeſt Walls and Fortifications in the World, is a Task unequal to my Knowledge; for I do not find the leaſt Mention made of the Perſon in any Hiſtory. Indeed in ſeveral reputable Authors, we have an Account of the Times and Places when and where this Infernal Invention was firſt put in Practice; the Teſtimony of whom I ſhall here inſert, notwithſtanding that they differ pretty much from one another. But as to the Inventer himſelf, we do not find the leaſt Mention made of him; which I cannot help being ſurprized at, ſince it ſeems to be a very great Injuſtice to Poſterity to conceal the Name of ſo great an Engineer from it. In Truth, I know not what to ſay or think of ſuch a Procedure, and ſhould be glad to know, whether it was through Chance, or premeditated Deſign, that the Writers in thoſe Times have left us dark as to this Matter. But every one may judge of it as he pleaſes; for my Part, I can only here entertain ſuch as are wholly Strangers to the Hiſtory of this Invention, with what can be gathered from the Teſtimony of ſeveral Authors.

Thuanus ſays, *All the Stratagems of the Duke of* Parma *before* Bergen op Zoom, *proving ineffectual, and deſpairing to carry it, and conſidering that the Seaſon was very far advanced, and that the Low-Country was almoſt overflowed; and finding that the Garriſons of the Iſland of* Tretole, *by their continual Excurſions and Depredations made Proviſions very ſcarce and dear in his Army, he reſolved to raiſe the Siege, and ſend his People into Winter Quarters, and accordingly he diſtributed ſome of his Troops in* Turenhalt, Roſendal, *and the Country of* Campen, *and ſent the reſt to join the Troops which were under the Command of Prince* Erneſt Mansfelt, *at the Siege of* Bon, *to block up* Wachtendonock, *which is an ancient Town of the* Sicambrians, *ſituate upon the* Niers, *not far from the City of* Gueldres. *This was done at the earneſt Intreaty of the Inhabitants of* Ruremond, *who begged to be delivered from the troubleſome Excurſions of the Robbers (it was thus they called the Soldiers of the neighbouring Garriſons.) Towards the End then of* October, *the Place was inveſted under the Conduct and Command of the aforeſaid* Mansfelt. *The Pioneers advanced and rais'd Batteries of Gazons or Sods, upon which they mounted their Cannon, which played upon the Town till they threw down the Roofs of the Houſes, and all the lofty Building in it. But they did not only* (ſays he) *ruin them with their Cannon, but they alſo galled them with* Grenadoes, *and* Balls *filled with combuſtible Matter, which they ſhot among them with certain Engines, ſo that the poor People could hardly find Safety any where from the horrid Tempeſt that was ſhowered down upon them.* He adds, *That thoſe Balls were made hard by, at a ſmall Town called* Venlo; *and that the Inventor of them reſolving to make Proof of his Work, at the Celebration of a Feſtival deſigned for the Entertainment of* William *the young Prince of* Cleves, *he had no ſooner ſet Fire to them, than they had an Effect quite contrary to what he intended, for the Town was fired by them, and was very near half deſtroyed.* A melancholy Diverſion.

This Author has hitherto pretty well informed us of the Place where our miſſive Thunder was invented, and of the Time it was firſt put in Execution: But another Writer, who equally deſerves our Credit, namely *Reidanus*, who has left us the Hiſtory of the *Low Country Wars* in *Latin*, ſeems to be of a quite contrary Opinion as to this Point. He ſpeaks thus: Adolphus Nivenarius, *Governor of* Gueldres, *reſolved to keep up the Scarcity of Proviſions as much as he could, and to ſtarve the Inhabitants of* Bergen, *if poſſible; but unhappily as he was proving his* Bombs, *with which he had determined to deſtroy the Enemy's Ammunition, he was greatly aſtoniſhed to find, that upon being fired they blew up the Arches and Vaults of the Caſtle of* Harnem, *together with ſeveral other fine Buildings. A brave Officer called* Denis, *and another Gentleman, periſhed by this Accident; and the Earl himſelf could not eſcape the Fire, for being cruelly burnt, he died a few Days after. Almoſt ſuch another Accident happened the Year before,* (he means 1587,) *at* Bergen op Zoom, *but of a more extraordinary Nature: A certain* Italian *who deſerted from the Duke of* Parma, *fled to the Confederates, to whom he pretended, that he had an admirable and unheard of Invention for preparing hollow Veſſels and Globes of Iron and Stone;* (ſure this was a thing impracticable, and I believe every *Pyrotechnician* will think it impoſſible to contrive ſo as to make Stone effectual in ſuch Works; but he goes on) *which might be eaſily thrown amongſt the Enemy, where they would do moſt terrible Execution by Thouſands of Splinters, which would fly from them in burſting; and beſides, that the leaſt Spark of them would infallibly ſet Fire to what it touched; but the Inſtant that the Grenadier was buſied in carrying on his Project, a Spark of Fire unfortunately fell upon the Table where he had prepared his Compoſition, and as he was going haſtily to take it away, the Fire (which loſes no Time) got hold on his Hand. He, aſtoniſhed to ſee a Glove of Flame upon his Hand, and not knowing what to do to get rid of it, clapped his Hand between his Thighs to ſtifle it; but far from being ſuppreſſed, it laid hold on his Breeches, and from thence penetrated to his Thighs. In a Word, his Hand was inſtantly ſtripp'd both of Skin and Fleſh. Vinegar proved ineffectual, and inſtead of extinguiſhing rather increaſed the Flame. To conclude, the Fire ſpreading over the reſt of his Limbs, the unhappy Man expired in leſs than three Days, after having ſuffered the moſt ſevere Pains without Intermiſſion or Relief.*

To the Teſtimony of theſe two grave Authors, I ſhall add that of a third, whoſe Fidelity is unqueſtionable, I mean *Famianus Strada*, who ſpeaking of the *Low Country* Wars, writes to this Effect: *There was nothing which more aſtoniſhed the Enemy* (he here means the Attack of *Mansfelt* at *Wachtendonock*) *than certain great Braſs Globes, hollow within, which were filled with Powder and Sulphur and other inextinguiſhable things, which were ſhot from great* Mortars, *with little Ropes in a ſmall Hole, and which by the Weight and Violence of their Fall, threw down the greateſt Part of the Buildings, and what is the moſt ſtrange of all, when they were lighted, their Flame caught hold of every thing within its Reach, with ſuch Obſtinacy that no Water could extinguiſh it. Theſe Globes, which gave the firſt Hint to the Invention of* Grenadoes, Fire-pots, *and ſuch like Inſtruments of Death, were invented* (*as we are told*) *by a Man at* Venlo, *a little before the Siege of* Wachtendonock, *though he happened to be the Deſtruction of his own Town: For upon a Day that the Inhabitants of* Venlo *made an Entertainment for the Duke of* Cleves, *this conſummate Artiſt making Experiment of his new Invention to divert that Prince, ſhot off one of them, which falling upon a large Building, broke down through it from Top to Bottom, and ſetting it in a Blaze, the Fire ran over all the Neighbourhood, ſo that in a very little Time two Thirds of the Town were laid in Aſhes. I know a certain Author,* (he means *Reidanus*) *who in his Hiſtory relates ſomething of this Kind to have happened a Month or two before at* Bergen op Zoom, *to an* Italian *Deſerter, who was going to make an Experiment of one of thoſe Balls. This Renegade promiſed the Confederate States to make certain hollow Veſſels or Globes of Iron or Stone, which being kindled and thrown into beſieged Places, ſhould ſet Fire to whatever they could reach, after having broke into a thouſand Pieces; but by a ſtrange Miſhap, a Spark of Fire fell upon the Compoſition he had prepa-*

red for theſe Globes, and the Flame caught hold of him in ſo frightful a Manner, that ſpreading all over him from one Limb to another, he died moſt miſerably, after having undergone the moſt exquiſite Torture, and left it doubtful whether or not he would have come up to what he promiſed. But however that might be, it appeared that thoſe Venlovian Engines *anſwered very well to the Purpoſe of* Mansfelt, *for with them he committed ſuch mercileſs Ravages, demoliſhed ſo many fine Buildings, and killed ſuch vaſt Numbers of People in the Places beſieged, that the Inhabitants could hardly find Shelter from the Tempeſt, which continually purſued them wherever they went, though they retired to Cellars and the moſt ſubterraneous Retreats. The Burgeſſes of the Town at length conſidering that this Storm of Iron and Fire threw them into the utmoſt Confuſion, and perceiving that it had demoliſhed all their Habitations, and that they ſhould inſenſibly loſe their Country, reſolved to go in a Body to* Laneteir *their Governor, to beſeech him to take Meaſures towards the Preſervation of their Lives and Fortunes, and to deſire him to reflect ſeriouſly upon their unhappy State. Upon the whole, they alledged that they were utterly deſtroyed by Degrees; that they had but a few Buildings left ſtanding; and added, that if this Enemy continued to ply them with their Grenadoes, it would be impoſſible for them to ſubſiſt, or make any farther Reſiſtance, except they built a new* Wachtendonock *under Ground, as they had already begun.*

I muſt confeſs, that what I have quoted from this Author is a little foreign to the Point in Hand; but he has expreſſed himſelf in ſo moving a Manner of this dreadful Contrivance, that I could not help tranſcribing of him at Length. It is from hence that the skilful *Pyroboliſt* may draw Concluſions in Favour of theſe Weapons: It is from hence he may perceive the Neceſſity there is for them in the Attack of Places in our Times. In ſhort, it is from hence that he may judge of their great Utility to the Beſiegers, by compelling the Beſieged to a ſpeedy Capitulation, by expediting the Surrender of Towns and Cities, and deſtroying thoſe that are moſt obſtinately bent upon defending themſelves.

Here I ſhould cloſe up this *Corollary*, as knowing that what I have quoted from theſe famous Hiſtorians has fully anſwered my Intention, which was to give an Account of the Origin of our Grenadoes. But ſince in this Work I act the Part of a *Pyroboliſt*, I think myſelf obliged to clear up every thing that may be obſcure in Relation to the Practice of our Art, for the Benefit and Inſtruction of thoſe who particularly apply themſelves to the Cultivation of it. Let us then look back to what we quoted from *Famianus Strada*, where he has ſeemingly deſcribed the Form, the Properties and Effects of our Grenadoes; and let us aſk him what he means by the *Fire-pots*, *Grenadoes*, &c. which, according to him, derive their Origin from the hollow Globes he ſpeaks of, ſince his Deſcription of them appears ſo nearly with that Sort of Arms which are now in Uſe with us. If he anſwers, that they were a Sort of Balls which in his Time were called *Bombs*, (which Word I know is promiſcuouſly uſed to this Day) I ſhall reply, that the Word *Grenado* would have ſuited better with them, as being a more general Term. If on the other Hand he alledges, that the little ones which we call *Grenadoes*, are Deſcendants of thoſe great Balls, his Aſſertion will in ſome Degree be falſly grounded: Thoſe who have the Leiſure, may on this Subject conſult *Leonardus Frouſpergerus*, in the Second Part of his *Military Art*, which he dedicated to *Rodolphus* II. who was at that Time duly elected King of *Hungary*, and who was afterwards Emperor of the *Romans* in the Year of Redemption 1573. But though I ſhould grant that the leſſer Sort of Grenadoes were unknown to paſt Times till after the Invention of the greater, and that it was from Experience of the Nature of the latter, that Men took it in their Heads to uſe the former; yet I ſhall never allow, that the Military *Olla* or *Fire-pots* are poſterior to the hollow Globes which he ſpeaks of, as he would have us believe; but very far to the contrary, I dare affirm, that our Grenadoes are derived from the Fire-pots; and I make no Scruple to ſay, that the *Ollæ* of the Ancients were the Lightning that preceded our modern Thunder; and this I may ſafely advance, ſince I have the Teſtimony of ſeveral great Authors, who lived in unſpotted Credit and Reputation among the Ancients, to ſupport me in it; from whence we may gather, that the moſt expert Captains in former Days met with very ſucceſsful Effects in their Sieges and Attacks from Fire-pots not very unlike ours. In the mean time, Reader, let what we have offered be kindly received by you; and aſſure your ſelf, that artificial Pots are of very old ſtanding; and that they are ſo far from deriving their Origin from Grenadoes or Bombs, that it is more reaſonable to believe the quite Reverſe. Pray hearken to what *Sextus Junius Frontinus* ſays of the Fire-pots of the Ancients. Cneius Scipio, *in a Sea Fight found out a Way of throwing Veſſels full of Pitch and Pine-wood, at the Enemy's Fleet, which were as dangerous in their Fall, becauſe of their Weight, as they were hurtful on the Score of the igneous Nature if the Matter they contained which was ſpread abroad from them. Dionyſius* ſpeaking of the Fireworks which were uſed at the Battle of *Actium*, between *Auguſtus Cæſar* and *Marc Antony*, obſerves, *That* Cæſar *perceiving his Soldiers very roughly handled by* Marc Antony's *Party, who cut them in Pieces with their Axes and Swords, and galled them terribly with their miſſive Weapons, from the Advantage they had of being in taller and better fortified Ships: he had Recourſe to Fire, as the beſt Remedy he could apply to the prevailing Evil. In ſhort, his Soldiers gathered round him, and began to throw Fire-Darts, Brands, and Torches, together with Pots full of Pitch, and burning Coals at the* Antonians, *which ſo annoyed them in their Ships, (though they took Care to keep as far out of Danger as they could) that the* Cæſareans *got the better of them. Thus what the Force of their Fire-Arms could not obtain, they effected by Fire; and thus by Means of that Element they triumphed over their Adverſaries.*

I could bring ſeveral other Authors to bear Witneſs in Favour of the Fire-pots of the Ancients, but I apprehend that theſe two will be ſufficient to convince you of their Antiquity.

BON-GRACE; (in a *Ship*) is a Kind of Frame made of old Ropes or Junks of Cables, which, in thoſe who ſail into cold Latitudes, are laid out at the Bows, Sterns, and Sides of the Ships, to preſerve them from being injured by the great Flakes of Ice.

BONA *Notabilia*, [in *Law*,] is where a Man dies, having Goods to the Value of Five Pounds, in divers Dioceſes, then the Archbiſhop ought to grant Adminiſtration; and if any inferior Biſhop do grant it, it is void.

BONA *Patria*, a Term in *Law*, ſignifying an Aſſize of Country-Men, or good Neighbours; ſometimes called *Aſſiſa bona Patria*, when twelve or more are choſen out of the Country to paſs upon an Aſſize; and they are called *Juratores*, becauſe they ſwear judicially in Preſence of the Party.

BONES *of an Animal Body*. A Bone is by Anatomiſts defined to be a ſimilar Part, moſt dry, cold, hard, inflexible, void of Senſe, and affording Stabiliment and Form to the whole Body.

The Integral or Conſtituent Parts of Bones, are their *Perioſteum* or inveſting Membrane, their Subſtance, Pores, Marrow, Glands, Veſſels, *&c.* of which take the following ſhort Account from Dr. *Haver*'s *Oſteologia*.

The *Perioſteum* hath two Sorts or Series of Fibres, the under deriv'd from the *Dura Mater*, the upper from the Membrane of the Muſcles that lies upon it; which Fibres lie one upon the other, but are not interwoven one with another.

The under Fibres run all parallel directly from one End of the Bone to the other, and are continued from one Bone to another by Means of the Ligaments that join them together in their Articulations, upon which they paſs

The outer hold the ſame Courſe with the Fibres of the Muſcle from whence they are derived, ſometimes ſtrait, ſometimes oblique, ſometimes tranſverſe, and when they have run ſo far as to make up their Part of the *Perioſteum*, he thinks they are inſerted into the Bone, and are ſucceeded by others from ſome other Muſcles. Some of the Tendons of the Muſcles alſo propagate Fibres to make ſome Part of the *Perioſteum*; but others penetrating it, are immediately inſerted into the Bone.

The inner Superficies of the *Perioſteum* ſticks as cloſe to the Bone as if it were glued to it; and beſides, the *Perioſteum* has little *Fibrillæ*, or Threads continued from it, that enter into the Subſtance of the Bone, which give them (probably) ſome internal Senſe.

The Uſes he aſcribes to it, are, 1. To be a Tegument to the Bones. 2. To convey Spirits into the Subſtance of the Bones for maintaining their Heat, for preſerving their Senſibility, and to aſſiſt in the Work of their Accretion and Nutrition, by Means of the minute Fibres it emits into them. 3. To help to ſet Limits to the Growth and Extenſion of the Bones, as the Bark is ſometimes obſerved ſo to bind young Trees, that it is neceſſary to open it before they can have the Liberty of thriving. 4. It is ſerviceable in the Conjunction of the Bones and their Epiphyſes (while theſe are Cartilaginous) alſo of the Bones which are joined by Sutures or Harmony, and in the Connexion of the Bones and their Cartilages. To join the Heads and Tendons of the Muſcles faſt to the Bones; namely, of ſuch Tendons as do not penetrate it (as ſome do not.)

Having done with the *Perioſteum*, he comes to the Subſtance of the Bones, which he deſcribes after this Manner. He ſays, they conſiſt of *Lamellæ* or Plates lying one upon another, and theſe of ſmall Strings or Fibres running lengthways of the Bones (like as we ſee in *Whalebone*;) which Strings, though ſome of them run to the very Extremities of the Bones, and others approach near to them, do not terminate there, ſo as to have diſtinct Ends, but they are, where they may be thought to terminate, ſtill continued, and run tranſverſly, and, as it were, arched, that the Strings of one Side of the Bone proceed as to meet and be united to thoſe that are propagated from the oppoſite; and this at both Extremities, that they are a Continuation, though not in the Figure, yet in the Manner of a Ring; therefore they are not all of a Length, but in every Plate they fall one ſhorter than another.

In ſeveral Bones, the *Lamellæ* are diſpoſed diverſly: In thoſe Bones which have a large Cavity, they are on every Side contiguous and cloſely united; but in thoſe which have not any great Cavity, but are altogether ſpongious within, many of the internal *Laminæ* are placed at ſome Diſtance from one another in all their Lengths, having betwixt them a cavernous Subſtance or ſmall Bony Cells; and ſo have alſo thoſe Bones, which have a large Cavity, ſome of thoſe leſſer Cells at both their Extremities.

Next he comes to their *Pores*, and ſays, That in the Bones whoſe Plates are contiguous, there are Pores through and between the Plates, beſides thoſe which are made for the Paſſage of the Blood-Veſſels; and theſe are of two Sorts; the one penetrate the *Laminæ*, and are tranſverſe, looking from the Cavity to the external Superficies of the Bone. The ſecond Sort are formed between the Plates, which are longitudinal and ſtrait, tending from one End of the Bone towards the other, and obſerving the Courſe of the Bony Strings. The firſt Kind are formed not only in the firſt internal *Laminæ*, but in every one, even to the outermoſt, though the nearer they are to the Cavity, the greater is the Number of the Pores. And as they paſs, they do not obſerve any ſuch Order as to lie directly one under another, to form any continued Paſſage from the Cavity to the external Plate. The ſecond Kind, *viz.* the Longitudinal, are not to be obſerved, but by good Glaſſes, unleſs it be now and then in ſome particular Bones. By theſe it is that the medullary Oil diffuſes itſelf, and is immediately beneficial to the Plates. The other, *viz.* the Tranſverſe, and but ſubordinate to theſe, are rather deſigned for the Paſſage of the Marrow into them, than for the immediate Communication of it to the Subſtance of the Bone.

The *Medulla* contained in the Bones, conſiſts (beſides the Blood-Veſſels) of an inveſting Membrane, in which are included membranous Lobules and Bags, and in theſe Bags, *Veſiculæ*, or Glandulous Bladders, very much like the veſicular Subſtance of the Lungs. And theſe glandular Bladders ſerve both for the Separation of the medullary Oil from the Maſs of Blood, and for the Reception and Conſervation of it. In an human Bone which he had preſerved till the medullary Oil was wholly evaporated, he found theſe *Veſiculæ* remaining dry, but entire, and their Subſtance repreſenting, in a Manner, a Sponge. They ſeem to have Pores or immediate Paſſages out of one into another (as have alſo the Bags) by which the Oil has a freer Courſe to the Joints and Subſtance of the Bone, for whoſe Benefit it was deſigned. By the ſtricteſt Enquiry he could never find any thing like Ducts (as paſs from other Glandules) and indeed theſe are not here neceſſary, becauſe the Oil is not carried from the glandular Veſſels to any large Receptacle, but flows out of the Superficies of the Marrow in as many Places as there are tranſverſe Pores in the internal *Lamella*. The *Medulla* ſerves to oil the Subſtance of every Bone, which, the drier it were, the brittler it would be: It lubricates alſo their Articulations, and hinders their Ends from being worn out or over-heated with Motion; and it moiſtens likewiſe the Ligaments, by which they are tied one to another. But in theſe two laſt Uſes it is aſſiſted by the Mucilage which is ſeparated by the *Glandulæ Mucilaginoſæ* (as he calls them) which he has obſerved in all the Articulations of the Bones, and are of the conglomerate Kind, of which he ſpeaks more in the next Chapter.

Now the Manner of the medullary Oils inſinuating itſelf through a Bone, and its being diſpenſed to all the Parts of it, is this: It firſt paſſes, being liquid (as it all is while the Animal is alive) out of the Cavity, through the tranſverſe Pores of the firſt internal *Laminæ*, and not having Pores of the ſame kind directly ſubjacent in the next Place to tranſmit it towards the Outſide of the Bone, it flows into the Longitudinal ones formed between theſe two (the firſt and ſecond) Plates, and being carried along in them till it find ſome tranſverſe Pores in the ſecond Plate, it paſſes through theſe, which when it has done, it is obliged again to alter its Courſe, to run into and flow along the ſtrait Pores between the ſecond and third *Lamina*. Thus it paſſes through and between the Plates ſucceſſively, till it has made its Way to the external Plate.

Thus the medullary Oil is diſpenſed in all the Bones to thoſe Plates, which are contiguous, and have no intermediate Cavities to entertain any medullary Glands of their own: But where the Plates ſtand at ſome Diſtance (as they do in ſuch Bones as have not any great Cavity) there are the ſmall Caverns above-mentioned, which are capable of containing ſome medullary Glands, from whence the Plates have more immediately, and without the former Method of Conveyance, the Benefit of the Marrow.

He divides the Blood-Veſſels of the Bones into *Nutritious* and *Medullary*. The moſt conſiderable of the Nutritious enter at the Ends of the Bone, *viz.* the Artery at one End, and the Veins at the other. The *Medullary* commonly enter the Sides of the Bones (and that obliquely, as the Ureters do the Bladder) both by one *Foramen*.

There are no *Nerves* that are inſerted into them (except into the Teeth) but theſe only run through the *Perioſteum* that inveſts them.

Some Bones have large Cavities in them, as *Os Humeri*, and *Femoris*, the *Ulna* and *Radius*, *Tibia* and *Fibula*, the Bones of the *Metacarpus* and *Metatarſus*, of the Fingers and Toes, and of the *Os Hyoïdes*; to which may be added, the lower Jaws; though the Cavity compared with the Magnitude of the Bone, hardly deſerves to be ſtiled large: Beſides theſe large Cavities which are in the Inſide of the Bones, there are leſſer Cells or Caverns in their Subſtance, which are found in all the Bones, even thoſe which have a large Cavity. But of theſe before, when we ſpoke of the Diſtribution of the Marrow.

Beſides the large Cavities and Caverns in the Inſide or Subſtance of the Bones, moſt have *ſuperficial Cavities* or *Sinus's*, which Dr. *Havers* diſtinguiſhes into *Sulci* or *Furrows* (which are the long ones) and *Pitts*, as he calls the ſhorter ones. And they have beſides, *Holes* for the nutritious and medullary Veſſels, as was but juſt now obſerved.

On the Outſides of the Bones there are alſo to be obſerved their *Prominences* or *Protuberances*, of which there be two Kinds; for it is either a continued Part of the Bone jetting manifeſtly above its plain Superficies, for the more commodious Inſertion of the Muſcles, *&c.* and is called *Apophyſis*, a *Proceſs*; or elſe it is like an additional Bone growing to another by ſimple and immediate Contiguity, (and generally ſofter and more porous than it) and is called *Epiphyſis*, an *Appendage*. If the Protuberance of the Bone be round, it is called its *Caput*; under which is the *Cervix*, as in the upper End of the Thigh Bone: If it be flat, it is called *Condylus*; if ſharp, *Corone*, from the Similitude they have to other things, as *Styloides*, *Coracoides*.

Their Uſes are many; for they ſerve, 1. For the Firmitude and Suſtentation of the Body, like Beams and Pillars in Houſes. 2. For a Defence to ſome Parts; ſo the Skull defends the Brain, the Ribs the Parts contained in the Breaſt. 3. For Progreſſion or Walking, of which they with the Muſcles are the only Inſtruments. 4. They give Shape to the Parts of the Body. Theſe are their general Uſes; as to their particular Uſes, thoſe will be ſhewn as we deſcribe them ſeverally.

BONIS *non amovendis*, is the Writ to the Sheriff of *London*, &c. to charge him, that one condemned by Judgment in a Nation, and proſecuting a Writ of Error, be not ſuffered to remove his Goods until the Error be try'd.

BONNET, [in *Fortification*,] is a certain Work raiſed beyond the *Counterſcarp*, having two Faces which form a Saliant Angle, and, as it were, a ſmall *Ravelin* without any Trench. The Height of this Fortification is three Foot, and it is environed with a double Row of Palliſadoes, ten or twelve Paces diſtant from each other. It hath a Parapet three Foot high; and is like a little advanc'd *Corps du Garde*. *F.*

BONNET *a Preſtre*, or the *Prieſt's Cap*, in *Fortification*, is an Outwork having at the Head three Saliant Angles, and two Inwards: It differs from the double Tenaille only in this, that its Sides, inſtead of being parallel, are made like a Swallow's Tail, that is, narrowing or drawing cloſe at the Gorge, and opening at the Head.

BONNETS, *in a Ship*, are ſmall Sails ſet on upon the Courſes, or her Main-ſail and Fore-ſail; when they are too narrow or ſhallow to cloath the Maſt. The Words are, *Lace on the Bonnet*, that is, faſten it to the Courſe; *Shake off the Bonnet*, that is, take it off the Courſe.

BOOK-KEEPING, is the Art of keeping Accompts, or recording the Tranſactions of a Man's Affairs, in ſuch Manner, that at any Time he may thereby know the true State of any Part of his Affairs, or the whole, with the greateſt Clearneſs and Diſpatch. The whole Articles and Branches of a Man's Buſineſs make but one General Account, which relates to him as the common Subject. But in order to have a diſtinct View of this general Account, it is neceſſary that it be divided into the moſt regular and natural Parts, *i.e.* into diſtinct and particular Accounts, according to the Variety of Subjects concerned in the whole. Now the moſt general and natural Diſtinction and Diviſion of Parts that can be made in a Man's Affairs, is into the Tranſactions relating to Perſons with whom we deal; and Things in which we deal. From this Diviſion of Subjects, Accompts are reduced to theſe two Claſſes, *viz. Perſonal* and *Real*. The End of *Book-keeping*, with Reſpect to theſe different Kinds of Accounts, is more particularly this, *viz.*

1. For *Perſonal Accompts*, to know what any Perſon owes to me, or I to him.

2. For *Real Accompts*, to know what Quantity and Value of every Kind of thing I have, or ought to have upon Hand, with the Gain or Loſs made upon that Subject within the Time of that Accompt.

The Ends of *Book-keeping* are obtained by Means of ſeveral Books of Accompts, whereof the chief and moſt neceſſary ones are the *Waſte* and *Ledger Books.* The *Waſte Book* begins with an Inventary of a Perſon's Effects and Debts, and contains a full Record of every Tranſaction, with all the Circumſtances, in a plain Narration of the Matter of Fact, every Article being placed here in the Order of Time; ſo that all Tranſactions of one Date lie next to one another.

That a Courſe of regular Accompts muſt begin with an Inventary, or Account of the preſent total State of a Man's Affairs, is very plain; for otherwiſe they cannot at any time afterward ſhew the true State either of the whole, or any of the Parts, *i. e.* the Subjects he was concerned with at the Beginning; for the State of an Accompt at any Time is the Effect of all the Tranſactions that have happen'd ſince a certain known Beginning or firſt State. It is plain, that to know the State of any Accompt, we muſt ſee the Articles relating to it all together; but in the *Waſte Book* they are ſcattered according to their Dates; therefore this Book alone is inſufficient, and the Defect of it ſhews the Neceſſity of another, and alſo points out the general Method of that other, which ſhall be next explained. In the mean time, we muſt look upon the *Waſte Book* as abſolutely neceſſary, and as the firſt Step in this Art, tho' it be no more but a Memorial of a Man's Buſineſs, containing the Materials of a more perfect Accompt, or of all the particular Accompts which are to be made up out of it, and carried on with it in the Ledger.

The *Ledger Book* contains all the Tranſactions of a Man's Affairs, in ſuch Order that the Articles relating to every diſtinct Subject lie together in one Place, making diſtinct particular Accompts, which is performed by the following Rules.

Rule 1. Every diſtinct Subject with which we have an Accompt, hath a diſtinct and ſeparate Space relating to it, containing an equal Portion of Right and Left Pages, with its Name written on the Head thereof, mark'd *Debtor* on the Left, and *Creditor* on the Right-hand Side, in which Spaces are recorded all the Tranſactions relating to that Subject by the following Rules. Every perſonal Accompt ſhews on the *Debitor* Side the Articles for which that Perſon is accomptable to me, and on the *Creditor* Side thoſe for which I am accomptable to him.

2. Every real Accompt ſhews on the *Debtor* Side the Quantity and Value of what was on Hand at the Beginning of the Accompt, and all afterwards received, with all the ſubſequent Charges, and on the *Creditor* Side what is given away (or any way gone out of it) and all the Return of Profit it has brought me.

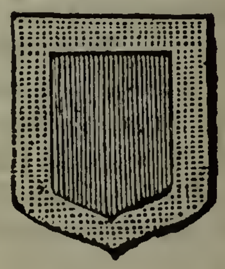
That we may underſtand the preceding Rules, we muſt make theſe further Reflections upon the Nature of Accompts.

1*ſt.* *As to Perſonal Accompts.* They are founded upon the mutual Credit any Perſon gives to me, or I to him, or generally upon Obligation contracted upon any Tranſaction, either with the Perſon obliged, or with a third Perſon, for I may have Buſineſs with one with whom I have no Accompt, and we ſhall eaſily know to diſtinguiſh the Tranſactions that do and do not require an Accompt.

2. All ſuch Tranſactions wherein we exchange equal Value of Money, Goods or Bills, ſo that there remains no Obligation upon the one of us to the other, have no Relation to an Accompt betwixt us, therefore an Accompt with any Perſon can never begin till a Tranſaction happen by which the one of us contracts a Debt, or is under an Obligation to the other, and all the ſucceeding Tranſactions that can belong to the Accompt, muſt either be Payment of former Debts, or new ones contracted, for whatever Cauſe, or by whatever Means. Now it may be reaſonably ſuppos'd, that a Tranſaction being fairly narrated, common Senſe and the plain Nature of Things is enough to make us know when a Perſon is brought under an Obligation or Debt to us, or we to them; and conſequently what Side of the Accompt it belongs to: As for Payment of former Debts, it is manifeſt it belongs to the Accompt, becauſe every Tranſaction which makes an Alteration in the State of Affairs muſt be ſhown, elſe it's certain the true State of the Accompt cannot be known; and for placing of Payment it is done thus: Payments made by me to any Perſon are placed on the *Debitor* Side of that Perſon's Accompt; and Payments made by any Perſon to me, are placed on the *Creditor* Side of that Perſon's Accompt.

The Reaſon of which is this: Debts new paid being formerly enter'd on the oppoſite Side, the Effect of what is now done is no more than to ſhew what is paid; for they being thus placed upon both Sides they balance one another, and ſhews us equally accountable, as ought to be, the Receiver being henceforth as really accountable to the Payer for what is paid, as he is to him for the Debt; that is, neither of them is ſtrictly Debtor to the other.

BORDURE, [a Term in *Heraldry*,] for an ancient Difference in a Coat of Arms, whereby ſeveral Families of the ſame Name, or Perſons bearing the ſame Coat, are diſtinguiſhed one from another. 'Tis a cutting off from within the Eſcutcheon all round it, about 1 5th of the Field; and if the Line that conſtitutes the *Bordure* be ſtrait, and the *Bordure* be plain, as they call it, then in Blazoning you muſt only name the Colour of the Bordure, as here, he beareth *Gules* a *Bordure Or*; without ſaying a *Plain Bordure.*



BORDURES, are ſometimes *Engrailed*, *Gobonated*, *Invected*, *Indented*, *Counter Compony*, *Vairy*, *Checky:* Which ſee under thoſe Words. If a *Bordure* be charged with any Part of Plants or Flowers, they ſay *Verdoy of Trefoiles*, or whatever Flower it be. If the *Bordure* conſiſt of *Ermins*, *Vairy*, or any of the Furs, the Term is *Purflew of Ermins*. If the *Bordure* be charged with *Martlets*, the Word is, charged with an *Enalyron of Martlets*, &c.

BOREAL or *Northern Signs*, are the ſix firſt Signs of the *Zodiack*, or thoſe on the *Northern* Side of the *Equinoctial.*

BOROUGH *Engliſh*, [a Term in *Law*,] is a cuſtomary Deſcent of Lands or Tenements in ſome Places, whereby they come to the youngeſt Son; or if the Owner have no Iſſue, to his youngeſt Brother.

BOTANICKS, or *Botany*, is that Part of the Art of Medicine which deſcribes and enumerates the ſeveral Virtues of Plants; and that Part of *Natural Hiſtory* which teaches rightly to diſtinguiſh the ſeveral Kinds and ſubordinate Species of Plants, Trees, Shrubs, &c. one from another, and which gives juſt Deſcriptions of them. And he that is accurate in this Art, is called a good

BOTANIST: See Schemes of the ſeveral Kinds of Plants under the Word *Plant.*

BOTANY or *Botanicks.* Books on this Subject; Mr. *Ray*'s *Hiſtoria Plantar.* 3 Vol. Fol. His *Synopſis Stirpium Anglican.* in 8vo. *Baſis Botanica. Auth. D. Chriſt. Ludovico Welſchio,* Lipſ. 1697. 12°. *Moriſon*'s *Præludia Botanica,* Lond. 1669. His *Univerſal Herbal.* Dr. *Plukenet*'s *Phytographia, Tournefort*'s *Method of Plants,* 2 Vol. 4to. both in *French* and *Latin.*

Plantar. Umbellif. Diſtributio Nova, per Tabulas Cognationis & Affinitatis, ex libr. Naturæ Obſervata Detecta, Auth. R. Moriſon, Oxonii, Fol. 1672.

Grew*'s Anatomy of Plants, and other Pieces. Marcelli Malpighii Anatome Plantarum,* &c. Lond. 1679.

Cowlei Angli ſex libri Plantar. Poematæ Latino conſcripti. Lond. 8vo.

Quadripartitum Botanicum Simonis Pauli, Med. Reg. in Dania. Argentorat. in 4to. *Almageſtrum Botanicum,* by Dr. *Plukenet.* Lond. 1696. Fol. *Dr.* Sloan*'s Catalogus Plantar. quæ in Inſula Jamaica Sponte proveniunt.* Lond. 1696. 8vo. *Icones & Deſcriptiones Rarior. Plantar. Siciliæ,* &c. *per* Paulum Boccone. 1674.

Leon Thurneiſſeri Hiſtoria Plantar. Berlini. 1578. Fol.

Johnſon*'s Herbal.* Fol.

Parkinſon*'s Herbal.* Fol.

Rivinus de Re Herbacea. 2 Vol. Fol.

Theophraſti Hiſtoria Plantar.

Jac. Breyneii Exotic. & minus Cognitar. Plantar. Centuria.

Fabius Columma de Stirp. Rarior. Cognitione. 2 Vol. 4to.

Hortus Indicus Malabaricus.

1. *Boccone Icones & Deſcriptiones Plantar. Italiæ, Galliæ,* &c.

BOTHRION, [Βόθριον of βόθρος, *Gr.* a Ditch] the Name of a kind of hollow, narrow, and hard Ulcer in the *Tunica cornea* of the Eyes. *Blanchard.*

BOTTOMRY, BOTTOMAGE, is borrowing or lending Money on the Credit of a Ship or Veſſel's ſafe Voyage.

BOTTONE, a Term in Heraldry for one of their Croſſes of this Figure, *Argent* a *Croſs Bottone Sable,* by the Name of *Winwood.*

BOULDER Walls, in Maſonry, Walls made of round Flints or Pebbles, which are found where the Sea hath a Breach caſt up, and alſo at ſome other Places where there are Plenty of Flints.

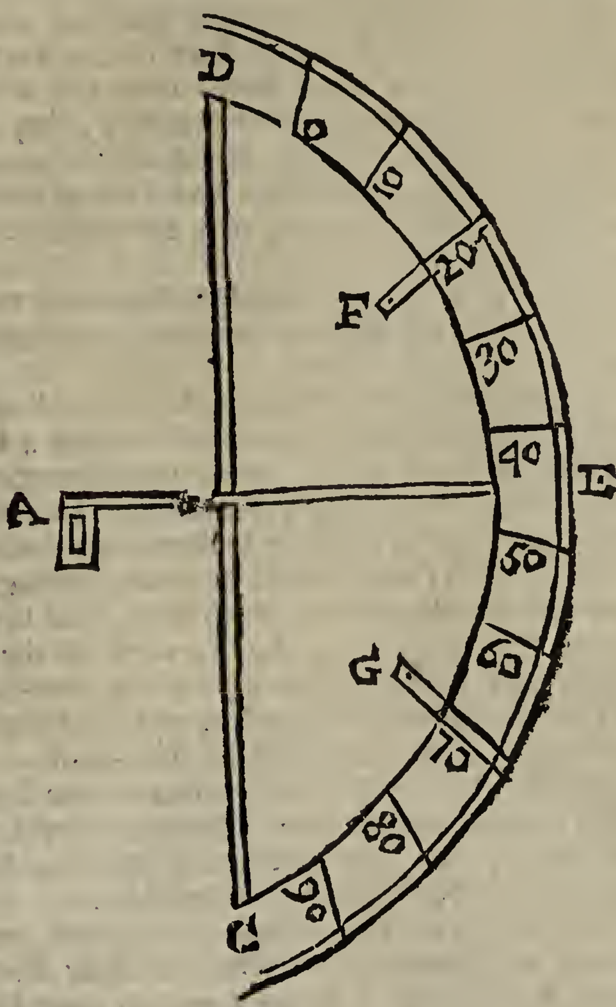
BOULTINE, in Architecture, is the Workmens Term for a convex Moulding, whoſe Convexity is juſt one-fourth of a Circle: 'Tis placed next below the *Plinth,* in the *Tuſcan* and *Doric* Capital.

BOW is an Inſtrument which hath been ſometimes uſed at Sea, conſiſting of only one large Arch of 90 Degrees, well and truly graduated, three Vanes, and a Shank or Staff, as you ſee in the Figure annexed:

Where D E C is the Arch, A E the Staff or Shank paſſing the Arch at 45 Degrees inmoſt, but in ſome in 50° or 55°. F is the Shade Vane, G the Sight Vane, and A B the Horizon Vane.

To take the Sun's Altitude *by it.*

By the Handle C hold the Bow upright, and move the Sight Vane G up and down, ſtill looking through the Sight till you ſee the Shade of the upper Part of the Shade Vane upon the Slit of the Horizon Vane; and that at the ſame Time you ſee alſo the Horizon through the Slit of the Horizon Vane: In doing of which if you ſee the Sky and not the Horizon, then draw the Sight Vane a little lower down towards C, but if you ſee the Sea and not the Horizon, then ſlide it a little upwards.



If it be the Meridian Altitude that is to be obſerved, you muſt wait and make Obſervation as oft as you think fit, till at laſt you begin to ſee the Sea inſtead of the Horizon. Then deſiſt; and the Differences between the Degrees and Minutes cut by the Sight Vane, and thoſe cut by the upper Edge of the Shade Vane, is the Diſtance of the Sun's upper Limb from the Horizon, from which if you ſubtract 16 Minutes, which is the Sun's Semi-diameter, the Remainder will be the Diſtance of the Sun's Centre from the Horizon, allowing for the Refraction: And you need not ſubtract above 8 or 10 inſtead of 16 Minutes for the Sun's Semidiameter, when a Ship-board, ſince you muſt allow for the Height of your Eye above the Level of the Water.

To obſerve the Height of a Star.

Place the Sight Vane at A, and the Horizon Vane at G, and looking through the Sight Vane at A, move the Vane F higher or lower, till you can ſee the Star at the Horizon, through the Horizon Vane at G: So ſhall the Degrees and Minutes between the two Vanes F and G be the Altitude of the Star ſought.

To take the Diſtance between two Stars.

Place the Sight Vane at A, and the Horizon Vane at G, as in the laſt Practice, and look through the Vane at A, moving the Vane F ſtill to and fro, till you can ſee the one Star through the Vane G, and the other by the Vane F; for then will the Diſtance between thoſe two Vanes F and G be the

Diſtance in Degrees and Minutes of the two Stars required.

BOW, of a Ship, is that Part of her which begins at the *Loof* and *compaſſing* Ends of the *Stem*, and ends at the Sternmoſt Part of the *Fore-caſtle.* If a Ship hath a broad Bow, they call it a *Bold Bow*: if ſhe hath a narrow thin Bow, they ſay ſhe hath a *Lean Bow.* The Piece of Ordnance that lies in this Place is called the *Bow Piece of Ordnance*; and the Anchors that hang here are called her *Great* or *Little Bower.*

BOW, a Mathematical Inſtrument made in Wood, formerly uſed by Seamen to take the Altitude of the Sun.

BOW, alſo, is a Beam of Wood or Braſs with three long Screws, that govern or direct a Lath of Wood or Steel to any Arch; uſed commonly to draw Draughts of Ships, Projections of the Sphere, or where-ever 'tis requiſite to draw large Arches.

BOW-SPRIT, is a kind of Maſt, reſting ſlopeways on the Head of the main Stem, and having its lower End faſtened to the *Partners* of the Foremaſt, and farther ſupported by the *Fore-ſtay*: It carries the *Sprit-ſail*, *Top-ſail*, and *Jack-ſtaff*; and its Length is the ſame with the Fore-maſt.

BOWER, any Anchor carried at the Bow of a Ship is called her *Bower*: There are uſually carried two there, the firſt and ſecond *Bower*; but the greateſt Anchor is carried in the Hold.

BOWGE, or rather *Bouch*, of Court, was formerly an Allowance of Diet or Belly Proviſion, from the King or Superior Lords to their Knights, Eſquires, and other Retinue, that attended them in any Expedition. *Kennet*'s Gloſſary.

BOWLING, or rather *Bow-Line*, is a Rope faſtened to the *Leach*, or middle Part of the Outſide of the Sail; it is faſtened in three or four Parts of the Sail, which is called the *Bowling Bridle*; but the *Mizen Bowling* is faſtened to the lower End of the Yard. All Sails have it except Sprit-ſail, and Sprit-ſail Top-ſail, and therefore thoſe Sails cannot be uſed cloſe by a Wind; for the Uſe of the Bowling is to make the Sails ſtand ſharp, or cloſe, or by a Wind: The Words belonging to it are theſe, *Sharp the Bowling*, *Hale up the Bowling*, *Set faſt the Bowling*, that is, pull it up hard, or hale it more, forward on; but when they ſay, *Eaſe the Bowling*, *check* or *run up the Bowling*, they mean, let it more ſlack.

BOWLING BRIDLES, in a Ship, are the Ropes by which the *Bow-lines* are faſtened to the *Leech* of the Sail.

BOWLING KNOT, is a Knot that will not ſlip, by which the *Bowling Bridle* is faſtened to the *Crengles.*

BOW-SPRIT-LADDERS, are Ladders in a Ship made faſt at the Beak-Head over the Bow-ſprit, to get upon it when there is Occaſion.

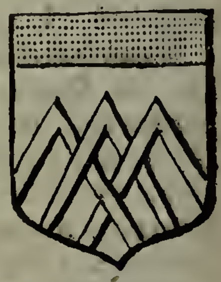
BOWSE, a Sea Term, ſignifying as much as *Hale* or *Pull.* Thus haling upon a Tack, is called *Bowſing upon the Tack.* And when they would have the Men pull all together, they cry, *Bowſe away.*

BOX *and Needle*, is the Application of a ſmall Compaſs to a Theodolite, and is uſed in *Surveying*, *&c.* to find out the Situation of Places, by the pointing of one End of the Magnetical Needle towards the *North.*

BOY, of an Anchor: See *Buoy.*

BOYAU, or *Branch of the Trenches*, in Fortification, is a particular Ditch ſeparated from the main Trench, which in winding about encloſeth different Spaces of Ground, and runs parallel with the Works and Fences of the Body of the Place; ſo that when two Attacks are made near one to another, the *Boyau* ſometimes makes a Communication between the *Trenches*, and ſerves as a Line of Contravallation not only to hinder the Sallies of the Beſieged, but alſo to ſecure the Miners. But when 'tis a particular Cut that runs from the Trenches to cover ſome Spot of Ground, it is then drawn parallel to the Works of the Place, that it may not be *Enfiladed*, that is, that the Shot from the Town may not ſcour along it. *F.*

BRACE, in Architecture, is a Piece of Timber framed in with Bevil Joints, and is uſed to keep the Building from ſwerving either Way: When a Brace is framed into the Kingleſſes or principal Rafters, 'tis called by ſome a *Strut.*



BRACED, the Term in Heraldy for the intermingling of three *Chevronels*; thus,

Azure, a *Chief Or*, and three *Chevronels* Braced in the Baſe of the *Eſcutcheon*, by the Name of *Fitz-hugh.*

BRACES, are Ropes belonging to all the Yards of a Ship except the Mizen, two to each Yard; there is a Pendant ſeized to the Yard Arms, at whoſe other End there is a Block, through which the Brace is reeved, and their Uſe is to *Square the Yard*, that is, to ſet it ſquare; to *Brace the Yard*, that is, to bring it to either Side; to *Traverſe the Yard*, that is, to ſet it any way overthwart; and to *Right the Yard*, that is, to bring it ſo that it ſhall ſtand at Right Angles with the Length of the Ship. All *Braces* come aftward on, the *Main Brace* comes to the *Poop*, the *Main Top-ſail Brace* to the *Mizen-top*, and thence to the *Main Shrouds*; the *Fore* and *Fore-top-ſail Braces* come down by the *Main* and *Main-top-ſail Stays*; and ſo of all the reſt. But the *Mizen Bowling* ſerves for a *Brace* to that Yard, and the *Croſs-Jack Braces* are brought forwards to the *Main Shrouds* whenever a Ship ſails cloſe by a Wind.

BRACHIÆUS *Externus*, is a Muſcle of the Cubit, which ſeems to be the third Beginning of the *Gemellus*; its Origination is continued from above the Middle of the inferior and back Part of the *Os Humeri* to its Cavity, which receives the *Olecranium* Extenſion of the Cubit, where joining with the Tendinous Outſide of the *Gemellus*, it is inſerted with it as aboveſaid. *L.*

BRACHIÆUS *Internus*, is a Muſcle of the Cubit, which derives its Name from its Situation, lying partly under the *Biceps*: It ariſeth fleſhy from the internal Part of the *Os Humeri*, at the Inſertion of the *Deltoides* and *Corachobrachialis* Muſcles, and deſcending over the Juncture of the *Cubit* with the Arm-bone, it is inſerted partly fleſhy and partly tendinous to the ſuperior and fore-part of the *Ulna*: Its Uſe is to help bend the *Cubit.* *L.*

BRACHIOLUM, is a kind of Index or Label put upon Aſtrolabes and other Projections of the Sphere; and by ſome *Engliſh* Writers is called a *Creeping Index.* *L.*

BRACHYCATALECTICK *Verſe*: See *Depoſition.*

BRACHYGRAPHY, [Βραχυγραφία, of βραχὺς, ſhort, and γραφὴ, Writing, *Gr.*] is the Art of Short-hand.

BRACKETS, in Gunnery, are the Cheeks of the Carriage of a Mortar: They are made of ſtrong Planks of Wood, of near a Semi-circular Form, and bound round with thick Iron Plates; they are fix'd to the *Bed* by four *Bolts*, which are called *Bed-bolts*; they riſe up on each Side of the Mortar, and ſerve to keep her at an Elevation, by the means of ſome ſtrong Iron Bolts (called *Bracket-bolts*) which go through theſe Cheeks or Brackets.

BRACKETS, in Carpentry, are a ſort of Stays or Supports for a Shelf, *&c.*

BRACKETS, in a Ship, ſmall Knees of Timber which ſerve to ſupport the Galleries; alſo thoſe Timbers which ſupport the Gratings at the Head.

BRADS, are Nails uſed in Building, having no ſpreading Heads as other Nails have: Of theſe ſome are called *Joiners Brads*, and are for hard Wainſcot; others *Batten Brads*, and are for ſoft Wainſcot; and ſome *Bill Brads* or *Quarter Heads*, which are uſed when a Floor is laid in haſte, or for ſhallow Joiſts which are ſubject to warp.

BRADYPEPSIA, [Βραδυπεψία, of βραδὺς, ſlow, and πεψία, *Gr.* Digeſtion] a too ſlow Digeſtion, proceeding from a depraved Diſpoſition of the acid Ferments in the Stomach.

BRAILS, are ſmall Ropes reeved thro' Blocks, which are ſeized on either Side the Ties, a little diſtance off, upon the Yard; ſo that they come down before the Sails of a Ship, and are faſtened at the Skirt of the Sail to the Crengles. Their Uſe is, when the Sail is furled a-croſs, to hale up its Bunt, that it may the more readily be taken up or let fall. Theſe Brails belong only to the two Courſes and to the Mizen Sail. The Word is, *Hale up the Brails*, or, which is all one, *Brail up the Sails*; for the Meaning is, that the Sail ſhould be haled up, in order to be furled, or bound cloſe to the Yard.

BRAIN, (ſee *Cerebrum* and *Cerebellum*) in the general Senſe of the Word, is taken for all the ſoft Subſtance which is contained within the whole Skull, and which the *Greeks* comprehended under the Word ἐγκέφαλος. It is the general Organ of Senſe, in which the Soul, the Governour of the Body, perceives and judgeth of the Senſations of all the Sentient Parts; and *out of which*, as out of a Fountain, it communicateth the Animal Spirits (bred in the Brain) by the Ducts and Rivulets of the Nerves to all the Sentient Parts of the Body; and thereby endows them with the Faculty of performing Animal Actions.

The Brain being of ſo looſe a Subſtance, and the Skull, wherein it is incloſed, ſo hard that the Saw or Chiſel are neceſſary to break thro' it, the Brain muſt needs be very much ſhattered or concuſſed thereby; and after the Skull is divided, in the very pulling of it off, the vaſcular Connection or the *Dura Mater*, and it with the *Pia Mater* and *Brain*, (and that alſo of the one with the other) being torn in ſunder, the Parts into which the Veſſels are inſerted, are neceſſarily much violated: And laſtly, after the Covers are removed, ſeveral Parts of the Brain being of ſuch difficult Acceſs, that others muſt be quite ſpoiled before one can come to a View of them, and theſe alſo thereby in part violated: Upon all theſe Accounts a true Anatomy of the Brain, as to its Contiguities, Connections, Cavities or Ventricles, *&c.* muſt be very difficult; ſo that 'tis no wonder the Obſervation of Anatomiſts are ſo different, and ſo oppoſite to one another. But this by the by: let us next diſcourſe of the Brain more gegenerally.

If by *Brain* we underſtand the whole ’Εγκέφαλος (or all that which is contained within the Skull) it is not of one *Subſtance*, but divers; and is diſtinguiſhed by the particular Names of the *Cerebrum*, (in ſpecial) the *Cerebellum*, and the *Medulla Oblongata.* Nor is the *Cerebrum* (*properly* ſo called) itſelf of a like Subſtance, but conſiſting of a Cortical and Medullary Part, (called *Corpus Calloſum*) and theſe differ in their Nature, Colour, and Conſiſtence. Which Difference *Malpighius* thus deſcribes: The *Cortex* (being of an Aſh-colour) he ſays, is Glandulous: The Outſide of the Glands is covered with the *Pia Mater*, and its Blood-Veſſels, which penetrate deep into their Subſtance; (each Gland having a Twig of both an Artery and a Vein:) Their Innerſide ſends forth a white nervous Fibre, like a proper Veſſel, as it were, ſo far as their Brightneſs and Whiteneſs permit one to diſcover. Theſe Fibres make up all the *Pith* (or *Corpus Calloſum*) which is of a more cloſe and ſolid Subſtance than the *Cortex*. They are flattiſhly round, and are not unlike thoſe white Bodies, or *Inteſtinula*, which the Teſticles are made up of; and in the Ventricles of the Brains of Fiſh they are ſo apparent, that if you hold them betwixt you and the Light, they repreſent the ſmall Teeth of an Ivory Comb. He ſaith, they are inſerted by their Ends into (or rather ariſe out of) the *Cortex* or Aſh-coloured outer Part of the Brain, and ſeem all of them to have their Egreſs out of (or rather Ingreſs into) the Trunk of the Spinal Marrow within the Skull.

Whether they be hollow or not, or whether as they are collected into a Bundle, they have not Pores and Interſtices ariſing therefrom, which tranſmit a peculiar Juice into the Nerves continued to them, he leaves undetermined; becauſe they neither admit of Ligature, nor can Senſe make any Diſcovery thereof. Dr. *Ridley* (from *Lewenhoeck*) offers at a yet finer Deſcription of theſe two Parts of the Brain, which the curious Reader may find in his *Anatomy of the Brain*, p. 89, *&c.* For the other Parts of the *Encephalos*, viz. the *Cerebellum* and *Medulla Oblongata*: ſee theſe Words.

The *Brain* receives Blood by *Arteries* derived from the *Carotides* and *Cervical*, whoſe Capillaries are diſperſed chiefly thro' its cortical Part. Theſe Arteries are ſo large and numerous, that a third part, at leaſt, of the whole Maſs of Blood is conveyed hither by them; which, ſeeing thro' the Smallneſs of the Brain it cannot be conſumed in its Nutrition, *Malpighius* thinks it probable, that the coagulative (or concreſcible) *Serum* is filter'd as it were in the *Cortex* (or Glandulous Part) of the Brain from the Arterial Blood, and that the Fibres of the *Cortex Calloſum*, as ſo many Roots implanted into the ſaid *Cortex*, imbibe this *Serum* and convey it to the *Medulla Oblongata*, as the Trunk from whence it is derived into the Nerves as the Branches, and is derived and is there the *Succus Nervoſus*, if not the Animal Spirit itſelf. Part nouriſhes the Brain itſelf, and what is ſuperfluous to both theſe Uſes, is partly reſumed by the *Veins* of the *Meninges*, (whoſe Twigs reach all the ſeveral Glands of the *Cortex*) and partly is repoſited in the *Sinu's* of the *Dura Mater*, by the Arteries themſelves, out of which it is reſorbed by the internal Branches of the Jugulars, and thereby conveyed back to the Heart. The Arteries inoſculate one with another, (*i. e.* the Right *Carotides* with the Left) and ſo do the Veins alſo; but not the Arteries with the Veins. It is from the Pulſe of the Arteries altogether, that the beating (or *Syſtole* and *Diaſtole* as it were) of the Brain proceedeth.

A Man, of all living Creatures, hath the *biggeſt Brain*; for it weigheth four or five Pound in ſome, and is as big again as an Ox's Brain.

The outer Surface is full of Windings, like thoſe of the Guts, which are ſeverally inveſted with the *Pia Mater*, as alſo tied together by it. The whole Brain is much of the ſame *Shape* with the Head, *viz.* roundiſh, but with Bunchings out towards the Forehead.

The whole Subſtance of the Brain is divided into two Parts; that which lies moſtly in the Fore-part of the Skull, is properly called the *Cerebrum*, and that which lies on the Back-part, under the Hind-part of the *Cerebrum*, is called the *Cerebellum*. Both the one and the other are contained in the *Meninges* and the *Cranium*, as in a Caſe of Bones, that nothing may hurt their tender Subſtance, which is ſoft. The *Cerebrum* is of a round Figure; it is divided by the firſt Proceſs of the *Dura Mater* into the Right and Left Side. Its external Surface reſembles the Turnings and Windings of the Inteſtines. In the *Cerebrum* we diſtinguiſh two different Subſtances, the external, which is of an aſhy Colour, and the internal, which is of a white Colour. Its external Subſtance is called *Subſtantia Corticalis*, or *Cinericea*; it is ſoft, glandulous, and of the Colour of Aſhes. Its internal, called *Subſtantia Medullaris*, is firmer, white, and fibrous; of it the Nerves are made, and it reaches to the Extremity of the *Medulla Spinalis*, where it divides into Fibres. The external Subſtance of the Brain, by its Circumvolutions, reſembles the ſmall Guts, and in the Middle of each Circumvolution is the Beginning of the Medullary Subſtance, ſo that the Cortical Subſtance is always on the external Side, and in the inner *Lamina* of the *Pia Mater* is co-extended with the Cortical Subſtance, which it immediately covers every where. *Malpighius*, who has nicely examined this Cortical Subſtance, ſays, that it is nothing but a Heap of little oval Glands which receive the capillary Branches of the Veins and Arteries which belong to the Brain, and which ſend out an infinite Number of Fibres, that altogether make up the Medullary Subſtance, which going out of the *Cranium* forms the Nerves and *Medulla Spinalis* contained in the *Vertebræ*. The internal Subſtance of the Right and Left Side of the Brain coming to join with one another, leave a Space between them, which forms the three Ventricles, or *Centrum Ovale*; the upper Part or Covering of this Space is called the *Corpus Calloſum*; the Bottom of this Space is the internal Subſtance of the two Sides of the *Cerebrum*, gathered together, as it were, in two Bundles, which are called *Crura Medullæ Oblongatæ*; upon them are the Protuberances called the *Corpora Striata*, and the *Thalami Nervorum Opticorum*. Theſe *Crura* uniting, make one Body, called the *Medulla Oblongata*; upon theſe are four Prominences called *Nates* and *Teſtes*; and behind theſe Prominences, the internal and medullary Subſtances of the *Cerebrum* being alſo divided into two Bundles, forms upon each Side of the *Medulla Oblongata* three more Protuberances, and then it paſſes out of the *Cranium* into the *Vertebræ*, where it gets the Name of *Medulla Spinalis*. This is a general Idea of the Structure of the Brain. As for its Parts,

Below the Depth of all the Circumvolutions of the Brain, the firſt Thing that appears immediately under the firſt Proceſs of the *Dura Mater* is the *Corpus Calloſum*, or the Covering of the two lateral Ventricles, formed by the Union of the Medullary Fibres of each Side. This being laid aſide, the two lateral Ventricles appear; they reach from the Fore-part of the *Cerebrum* backwards; they are pretty broad in their Hind-part; but they grow narrower towards the Fore-part. They are divided into the Right and Left Ventricle by a thin tranſparent Membrane, which comes from the under Side of the *Corpus Calloſum*, and is extended to the *Fornix* which is in the Bottom of the Ventricles; this Membrane is called *Septum Lucidum*; it is thought to be a Production of the *Pia Mater*, which covers all the Sides of the Ventricles.

In theſe Ventricles there are four Prominences, two in each Ventricle; the foremoſt two are called *Corpora Striata*, which are the Tips of the *Crura Medullæ Oblongatæ*; they are oblong, and their Extremities come down upon the Sides of the two other Prominences; they are of a cineritious Colour without, but in their internal Subſtance there are many white Streaks, which are the Medullary Subſtance mixed with the Cineritious and Glandulous. They are, as it were, tied together by a Medullary Proceſs called *Commiſſura Craſſioris Nervi Æmula*. The two other Prominences are called *Thalami Nervorum Opticorum*, becauſe the Optick Nerves riſe out of them; they are Medullary without, but a little Cineritious within; they are of an oblong Figure upon the upper Part of the *Crura Medullæ Oblongatæ*; between them there is a Medullary Tract, which encompaſſes them, called *Limbi Poſteriores Corporum Striatorum*: Upon them alſo lies the *Plexus Choroides*, made of Veins, Arteries, and little Glands. This *Plexus* reaches from one lateral Ventricle to the other, paſſing under the *Fornix*, above the third Ventricle. It ſends a Branch to the fourth *Sinus* of the *Dura Mater*. In the Middle above the *Corpora Striata* and the *Thalami Nervorum Opticorum*, there lies a thin and broad Production of the Medullary Subſtance, which comes from the Fore-part of the Ventricle by two Roots, and reaches to the Hinder-part, where it ends by two other Protuberances call'd its *Crura*, which covers a great Part of the *Thalami Nervorum Opticorum*. This Production is call'd the *Fornix*, becauſe it is a Covering to the third Ventricle. Under the *Fornix* there is a *Rima* between the *Crura Medullæ Oblongatæ*, which is the third Ventricle, it being a little dilated in its third Part: There is a Hole that goes down to the *Glandula Pituitaria*; this Hole is the Entry to the *Infundibulum* or Funnel, ſo call'd becauſe of its Figure: It is a ſmall Conduit made of the Medullary Subſtance, cover'd with the *Pia Mater*; it pierces the *Dura Mater* upon the Baſis of the Skull, and ſinks into the Subſtance of the *Glandula Pituitaria*, which is ſituated in the *Cella Turcica*, cloſely cover'd with the *Pia Mater* and *Dura Mater*; it is of a harder Subſtance than the other Glands of the Body; it receives the End of the *Infundibulum*, which carries a Liquor from the Ventricles into this Gland, which is ſurrounded by the *Rete Mirabile*, or a *Plexus* of ſome Branches of the *carotidal* and *cervical* Arteries, which break the Impetus of the Blood, and abate the Velocity as it paſſes thro' the tender Subſtance of the Brain. In the Hinder-part of the third Ventricle there is another ſmall Hole call'd *Anus*, which leads into the fourth Ventricle in the *Cerebellum*. In the Upper-part of this Hole is ſituated the *Glandula Pinealis*, about the Bigneſs of a Pea; it is compoſed of the ſame Subſtance as the reſt of the Brain, and for the ſame Uſe. It is tied by ſome Fibres to the *Nates*, which are two Prominences of the *Medulla Oblongata*, ſituated above the Fore-part of that Conduit, which leads from the *Anus* to the fourth Ventricle; they are of an oval Figure, pretty big, and immediately behind them are two other Prominences of the ſame Figure and Subſtance, call'd *Teſtes*, both cover'd with a Net of Blood Veſſels. There is a ſmall tranſverſe Medullary Protuberance behind the *Teſtes*, from which the *pathetick* Nerves ariſe. The Conduit which reaches from the *Anus* to the fourth Ventricle, is in that Part of the *Medulla Oblongata* which is betwixt the *Cerebrum* and *Cerebellum*, call'd the *Iſthmus*. The Upper-part or Cover of this Conduit, which is betwixt the *Teſtes* and the foremoſt vermicular Proceſs of the *Cerebellum*, to which two it is tied at its two Ends, and to the Proceſſes which come from the *Cerebellum* to the Teſtes at its Sides, is called *Valvula major*; it is of a Medullary Subſtance; its Uſe is to keep the *Lympha* from falling out above the Nerves in the Baſis of the Skull. Theſe are all the Parts of the *Cerebrum.*

The *Cerebellum*, which is much leſs, is alſo compoſed of a Cortical and a Medullary Subſtance; its Superficies makes not Turnings and Windings as that of the *Cerebrum*, but its Foldings are ſtrait, and they reſemble the Segments of Circles, or the Edges of Plates laid on one another; and theſe Segments are largeſt in its Middle, and they grow leſs as they approach its Fore and Hind-part, where they ſeem to reſemble two Worms, and therefore called *Proceſſus Vermiformes.* The Medullary Subſtance of the *Cerebellum* as it approaches the *Medulla Oblongata*, gathers together, and then divides equally into two Bundles, which are joined to the two Sides of the *Medulla Oblongata*; as they ſeparate, they leave a little Space upon the Upper-ſide of the *Medulla*, which is called the *Fourth Ventricle*; and its further End, becauſe of its Reſemblance, *Calamus Scriptorius.* The Top of this Ventricle is covered with ſeveral Blood-Veſſels woven like a Net. The Medullary Subſtance of the *Cerebellum* makes three Proceſſes upon each Side of the *Medulla Oblongata*: The firſt two go on each Side to the *Teſtes*: The *Valvula major* is betwixt them. The ſecond two are pretty broad; they go ſtrait down on each Side, and meet on the Under-ſide of the *Medulla*; they make it look bigger, being like two Cords upon its Sides.

This is all that is remarkable in the *Cerebrum*, *Cerebellum*, and Upper-ſide of the *Medulla Oblongata*; but upon turning the Brain, may be diſtinctly ſeen the Riſe of all the Nerves, the *Infundibulum*, two white Spots behind it, the *Crura Medulla Oblongata*, one on each Side the *Cerebrum*; where they join may be ſeen the *Proceſſus Annularis*, or *Pons Varolii*; and beyond that there are two Prominences called *Corpora Pyramidalia*, they are about an Inch long, and on each Side of them, towards their lower End, there are two more, which, becauſe of their Figure, are called *Corpora Olivaria*; and then the *Medulla Oblongata* goes out of the Skull, being contained in the *Pia* and *Dura Mater.*

The Veſſels of the Brain are Nerves, Arteries and Veins. The Nerves are ten Pair; the firſt Pair are the *Olfactory* Nerves, they riſe from the Baſis of the *Corpora Striata*, and paſs thro' the Holes of the *Os Cribriforme*; the ſecond Pair are the *Optick* Nerves, they riſe partly from the Extremities of the *Corpora Striata*, and partly from the *Thalami Nervorum Opticorum*, which they almoſt embrace; they unite together above the *Cella Turcica*, and immediately dividing again, they paſs through the two foremoſt Holes in the *Os Sphænoides*; the third Pair are the Movers of the Eyes, they riſe on each Side the *Infundibulum* from the *Medulla Oblongata*, and go out at the *Foramina lacera*; the fourth Pair are the *Pathetick* Nerves, they riſe from the ſmall Medullary Cord which is behind the *Teſtes*, and paſs thro' the *Foramina lacera*; the fifth Pair riſe from the Forepart of the *Proceſſus Annularis*, they give Nerves to the *Dura Mater*, each of them divides into three Branches, the firſt paſſes out at the *Foramen Lacerum*, the ſecond at the third Hole of the *Os Sphænoides*; and the third thro' another Hole of the ſame Bone.

BRAKE in a Ship, is the Term for the Handle of a Pump.

BRANCH *of the Trenches*: See *Boyau.*

BRANCHES, [in *Architecture*] the Arches of Gothick Vaults; which Arches tranſverſing from one Angle to another, diagonal ways, form a Croſs between the other Arches, which make the Sides of the Square, of which the Arches are Diagonals.

BRASS, [Bꞃæꞅ, *Sax.*] is a Metal made out of a Mixture of Copper and *Lapis Calaminaris* (which is uſually called *Calamine*). This Stone is dug out of ſeveral Mines in the *Weſt* of *England* (as about *Mendipp*, &c.) about 20 Foot deep. It is burnt or calcined in an Oven or Kiln made red hot, then ground to Powder, and ſifted as fine as Flour; then mix'd with ground Charcoal, becauſe the Calamine is apt to be clammy, to clod, and ſo is not eaſily incorporable. Then they put about 7 ℔ of Calamine into a melting Pot, holding about a Gallon, and uppermoſt about 5 ℔ of Copper. The Calamine muſt be mix'd with as many Coals as will fill the Pot. This is let down with Tongs into a wind Furnace 8 Foot deep, and remains there 11 Hours; for they caſt not off above twice in 24 Hours. One Furnace holds 8 Pots. After melting, it is caſt into Plates or Lumps. 45 ℔ of Crude Calamine produces 30 ℔ burnt or calcined. They uſe *Braſs Shruff* ſometimes inſtead of ſo much Copper; but that cannot always be procured in Quantities, being only a Collection of Pieces of old Braſs.

The beſt Braſs Guns are made of malleable Metal, and cannot be made of pure Copper or Braſs; but it is neceſſary to put in coarſer Metals to make it run cloſe and ſounder, ſuch as Lead and Pot-Metal. *Bell-metal* being Copper and Tin, and *Pot-metal* Copper and Lead. About 20 ℔ of Lead is uſually put into 100 ℔ of *Pot-metal*, but about 6 ℔ is ſufficient to put into 100 ℔ of *Gun-metal.*

The Calamine Stones were heretofore fetch'd from *Poland*, but are now exported from us by the *Dutch.*

The Manufacture of Braſs was privately kept in *Germany* for many hundreds of Years, wherein many thouſands are employed, and all were maintain'd; ſome having thereby raiſed themſelves to great Eſtates. *Phil. Tranſ. N.* 200 and 260.

BRAZING is a Kind of ſoldering of Iron, when the Work is ſo thin that it will not bear *Welding*, they lay ſmall Pieces of Braſs on the Places that are to be brazed, and ſtrew a little Powder of Glaſs upon it to make the Braſs run, and give it an Heat in the Forge till they find that the Braſs is run, and then they take it out and let it cool.

BREACH, in Fortification, is the Ruins which are made in any Part of the Works of a Town, *&c.* either by playing Cannon, or ſpringing Mines, in order to ſtorm the Place, or take it by Aſſault. They ſay, *Make good the Breach*, *Fortify the Breach with* Chevaux de Friſe, *Make a Lodgment on the Breach*; *Clear the Breach*, or move away the Rubbiſh of it, *&c.*

To BREAK *Ground*, in Fortification, ſignifies to begin the Works for carrying on the Siege about a Town or Fort.

BREAMING, of a Ship, ſee *Brooming.*

BREAST *Caskets*, [with *Mariners*] the largeſt and longeſt Caskets, which are a Sort of Strings placed in the Middle of the Yard.

BREAST *faſt*, [in a *Ship*] a Rope faſtened to ſome Part of her forward on, to hold her Head to a Warp, or the like.

BREAST *Hooks*, [with *Ship-Wrights*] are the compaſſing Timbers before, that help to ſtrengthen her Stern, and all the Fore-part of the Ship.

BREAST *Ropes*, [in a *Ship*] are thoſe Ropes, which faſten the Yards to the Parrels, and with the Parrels hold the Yards faſt to the Maſt.

BREAST-WORKS, the ſame with *Parapet*.

BREASTS, in Women and other Females, are of a Subſtance conſiſting of a great Number of oval Glands lying in a great Quantity of Fat; Their excretory Ducts approach the Nipple, join and unite together, till at laſt they form ſeven, eight, or more ſmall Pipes called *Tubuli Lactiferi*, which have ſeven croſs Canals, by which they communicate with one another, that if any of them be ſtopp'd, the Milk which was brought to it might not ſtagnate, but paſs through by the other Pipes, which all terminate in the Extremity of the Nipple.

The Nipple is a ſpongeous Subſtance, made of two Orders of Fibres: the ſmalleſt make a fine Net-work within the largeſt Spaces of the Net-work of the bigger Fibres. Through it paſs the *Tubuli Lactiferi*, which grow ſmaller and ſmaller to their Extremities, that the Milk might not run out, but when the Breaſts are full, or upon Suction: It has an exquiſite Senſe, and a ſmall Erection when it is handled.

The Arteries and Veins of the Breaſts are Branches of the Subclavian and Intercoſtal. They have Nerves from the Vertebral Pairs, and from the ſixth Pair of the Brain.

The Uſe of the Breaſts is to ſeparate the Milk for the Nouriſhment of the *Fœtus*. The Arteries which terminate in the Glands, which compoſe the Subſtance of the Breaſts, bring the Blood pregnate with a Child which has received its laſt Perfection by its Circulation through the Lungs; this Chyle being ſeparated by the Glands of the Breaſts, runs through the *Tubuli Lactiferi* upon the Suction of the Child.

The Breaſts in Men are very ſmall; they are chiefly for Ornament. I have ſeen ſome Men who have had Milk in them. *Keil.*

BREDEWITE was anciently a Fine, Penalty or Amercement in default in the due Aſſize of Bread: And King *Henry* II. granted, among other Things, to the Tenants of the Honour of *Wallingford*, *Oxon*, That they ſhould be *Quieti de Bredewite.*

BREECHINGS; ſo the Seamen call thoſe Ropes with which they *laſh faſt*, or faſten their great Guns to the Ship-ſides.

BREEZE, a ſhifting Wind, blowing from the Sea or Land for ſome certain Hours of the Day or Night.

BREGMA, [Βρέγμα of βρέχω, *Gr.* to water, becauſe thoſe Parts are generally obſerved to be moiſt] the Fore-part of the Head; or as ſome ſay, the Fore-head Bone, or the Side and Shelving Bone of the *Cranium* on each Side of the Sagittal Suture.

BREST is a Term in Architecture, uſed by ſome for that Member or Column which is called the *Thorus* or *Tore*.

BREST *Summers*, in a Timber Building, are the Pieces in the outward Parts of any Building, and in the middle Floors, (not in the Garret, nor in the Ground Floor) into which the *Girders* are framed.

BRETESSE [in *Heraldry*] the ſame that the *French* frequently call *Des Baſtonades*, and the *Engliſh* embattled, counter-embattled, *i. e.* embattled on both Sides.

BREVE [in *Muſick*] a Note or Character of Time in the Form of a Diamond, ſquare, without any Tail, and equivalent to two Meaſures or Minims.

BREVE *Perquirere*, to purchaſe a Writ or Licence of Trial in the King's Court, by the Plaintiff, *qui breve perquiſivit*. Hence the preſent Uſage of paying 6 *s.* and 1 *d.* where the Debt is 40 *l.* and 18 *s.* where the Debt is 100 *l.* and ſo upward in Suits of Money due upon Bond. *L.*

BREVE *de Recto*, a Writ of Right, or Licence, for a Perſon ejected, to ſue for the Poſſeſſion of an Eſtate detained from him. *L.*

BREVE-VAS, a ſhort Vein paſſing from the Stomach to the Veiny Branch of the Spleen. 'Tis commonly called the *Vas Breve*. *L.*

BREVIBUS *&* *Rotulis liberandis*, is a Writ or Mandate to a Sheriff, to deliver unto the new Sheriff, choſen in his Room, the County with the Appurtenances, *una cum Rotulis Brevibus*; and all other things belonging to that Office. *L.*

BREVIS *Muſculus* [*Anatomy*] a Muſcle of the *Radius*, which ariſes from the ſuperior and poſterior Part of the *Humerus*, and helps to ſtretch out the Hand forward. *L.*

BREVIS *Palmaris* [*Anatomy*] lies under the *Aponeuroſis* of the *Palmaris*, ariſing from the Bone of the *Metacarpus* which ſuſtains the little Finger, and paſſes tranſverſely thro' that Bone, and that of the *Carpus*, which lies above the reſt, and is inſerted into the eighth Bone of the *Carpus*. The Uſe of it is to make the Palm of the Hand concave or hollow.

BREVIS *Radii* [*Anatomy*] comes from the outward and ſuperior Part of the *Ulna*, and paſſes round the *Radius*, and is inſerted into the ſuperior and fore-part of it, below the Tendon of the *Biceps*. Its Uſe is to turn the Palm of the Hand upwards.

BRIBOR (a *French* Law-term) ſignifying one that pilfereth another Man's Goods.

BRICKS. The ſeveral Kinds of Bricks uſed in Architecture are theſe: 1. *Compaſs Bricks*, which are of a Circular Form, and are uſed in ſteyning of Wells. 2. *Concave* or hollow *Bricks*, being on one Side flat like a common Brick, but on the other hollowed: They are uſed to convey Water. 3. *Cogging Bricks* are uſed to make the indented Work under the Coping of Walls built of great Bricks. 4. *Coping Bricks*, which are formed on Purpoſe for coping of Walls. 5. *Dutch* or *Flemiſh Bricks*, uſed to pave Yards and Stables, and for Soap-Boylers Fatts, and for Ciſterns. 6. *Clinkers* are ſuch Bricks which are *glazed* by the Heat of the Fire in the making. 7. *Feather-edg'd Bricks* are like the common Statute Bricks, only they are thinner on one Edge than on the other, and are uſed to pen up the Brick Pannels in Timber Buildings. 8. *Didoron* was a Brick uſed by the Ancients, of 1 ½ Foot, or two Spans long, (whence the Name) and one Foot broad. This was the ſmalleſt ſort of Bricks uſed by the *Greeks* in their private Houſes, for there was a large ſort in uſe in their publick Edifices, which they called, 9. *Pentadoron*, which was 3 Foot 9 Inches long, and 1 Foot broad. 10. *Samel* or *Sandal Bricks*, are ſuch as lie outmoſt in a Kiln or Clamp, and conſequently are ſoft and uſeleſs, as not being thoroughly burnt. 11. *Great Bricks*, are 12 Inches long, 6 broad, and 3 thick: The Weight of one about 15 Pound; ſo that 100 will weigh 1500, and 1000 of them 15000 Pound. Their Uſe is to build Fence Walls, together with 12. *Pilaſter* or *Buttreſs Bricks*, which are of the ſame Dimenſions with them, only they have a Notch at one End, of Half the Breadth of the Brick. Their Uſe is to bind the Work at the Pilaſters of Fence Walls, which are built of great Bricks. 13. *Paving Bricks* or *Tiles*, theſe are of ſeveral Sizes in ſeveral Counties. 14. *Place Bricks* are ſuch as are made in a Place made on Purpoſe for them near the Building they are to be uſed in. 15. *Statute* or *ſmall common Bricks*:

Bricks: Theſe ought to be 9 Inches long, $4\frac{1}{2}$ broad, and $2\frac{1}{2}$ thick; 100 of theſe uſually weigh about 550 Pound, and conſequently 1000, 5500 Pound, and about 407 in Number are a Tun Weight. Theſe are commonly uſed in paving of Cellars, Hearths, Sinks, *&c.* 30 or 32, if true Meaſure, will pave a Yard ſquare, and 330 will pave a Square of 100 Foot, laid flat; but if laid Edge-ways, they muſt be double in Number.

Bricks are burnt either in a *Kiln* or a *Clamp:* Thoſe that are burnt in a *Kiln*, are firſt ſet or placed in it, and then the Kiln being covered with Pieces of Bricks, they firſt put in ſome Great or Cord-Wood to dry the Ware with a gentle Fire, which is continued 'till the Ware is pretty dry, which they know by the Colour of the Smoak turning from a whitiſh dark to a black tranſparent Smoak; then they put in no more Wood, but proceed to *burn the Bricks* with Bruſh, Furze, Straw, Heath, Brake or Fern Faggots, having firſt damm'd up the Mouth of the Kiln with their *Shinlog* as they call it (which is Pieces of Bricks piled up one on another, and then cloſed up with wet Brick Earth inſtead of Mortar) only leaving juſt Room to put in a Faggot. They then continue to put in more and more Faggots, 'till they make the Kiln and its Arches look white with Heat, and that the Fire begins to appear at the Top of the Kiln. Then they begin to ſlacken the Fire for about half an Hour or an Hour, and ſo let all cool by Degrees. The Ware will be burnt uſually in about 48 Hours: But now-a-days about *London*, they uſually burn Bricks in *Clamps*, which are built of the Bricks to be burnt, ſomething after the Manner of the Arches in Kilns, *viz.* with a Vacancy between each Brick's Breadth, *&c.* for the Fire to play through; but with this Difference, that inſtead of arching, they *truſs* or *ſpan* it over, by making the Bricks project one over another on both Sides the Place, for the Wood and Coals to lie in, till they meet, and are bounded by the Bricks at the Top, which cloſes all up. The Place for the Fuel is carried up ſtrait on both Sides, 'till about 3 Foot high, then they fill it almoſt with Wood, and over that lay a Covering of Sea-coal; and then they over-ſpan the Arch: But they ſtrew Sea-coal alſo over at the Clamp, betwixt all the Rows of Bricks, then they fire the Wood, and then the Coal, and when all is burnt out, they conclude the Bricks burnt enough. *Builders Dictionary.*

BRICOLS, are by ſome ſaid to be Engines, formerly uſed to batter the Walls of Towns or Caſtles.

BRIDGES. 1. Of what Thickneſs or Subſtance the Butments of all Sorts of Stone Bridges ought to be, or what Proportion they ought to bear to the Arches, and the Weights they are to ſupport.

2. What Proportion the Peers or Pilaſters ought to bear to the Apertures or Heighths of the Arches, and the Weights they are laden by.

3. What ought to be the Length of the Vouſſoirs from their Intradoſſe to their Extradoſſe, or from their Inner Face to their Outer Face, for Arches of all Sizes quite up to their Key Stone.

4. What Sorts of Arches fixed upon one and the ſame Diameter, would be capable of ſuſtaining the greateſt Burthens, and their ſeveral and exact Degrees of Strength, whether they be of an Elliptical, Circular, or whether they be of the third Point or Gothic, and carried up to what Height you pleaſe.

5. To theſe four Propoſitions we ſhall add a Fifth, which is to determine the Thickneſs or Profile of Walls for ſupporting the Sides of Cauſways, Banks, and Ramparts of Fortifications to any Height, *&c.* It is pretended that the late Monſ. *Mareſchal Vauban* has laid down Rules and Directions with Regard to Fortifications, which will obtain in all the Caſes here propoſed, from 10 to 80 Foot in Height of Earth newly removed and not ſettled: But as what he advances is only founded upon Experience of 500,000 Cubical Toiſes or Fathoms of Stone-Work, perform'd in the fortifying of 150 Places, by the Command of *Lewis* the Great, which had no farther Proof of its Validity or Soundneſs than the Succeſs which always attended that Gentleman in the Execution of the aforeſaid Works, it is required that there be ſome Demonſtration given with Regard to this Matter, as well as with relation to the four preceding Propoſitions, to the end that there may be ſome certain Rules eſtabliſhed to guide us in the Proſecution of theſe Works; a Thing unattempted hitherto.

Theſe Principles which are here to be laid down, muſt be well known and indubitable:

Which Principles muſt be explain'd by evident Terms, and in a known Language, that they be intelligible to every Body, and lie open to their Judgement.

Now it will require no extraordinary Genius to comprehend what I have to offer towards the clearing up of the five Difficulties here propoſed; and I am not without Hope, that the meaneſt Workman that has but common Senſe of his Side, will unravel and demonſtrate what I have here to advance.

1. By the Aſſiſtance of common Senſe, and by Help of ſome ſmall Smattering in Phyſics, and ſome Skill in Argument, together with a little Experience, you may readily comprehend the Combination or Conjunction of the ſeveral Materials concerned in the Building of Arches and Vaults; for they will give to underſtand, that were it not for the ſeveral Methods of ſquaring or cutting of Stone, or for the Mortar which binds them together, it would be altogether impoſſible to conſtruct an Arch of any Sort: The Ancients ſometimes only practiſed the firſt Method above in their very fineſt Works, without making any Uſe of Mortar, as may be obſerved in the Archivolts of their Arches, whoſe Vouſſoirs have no Mortar at all between their Joints. An Example of this is ſtill viſible in the Antique Aqueduct du Gard in *Languedoc* and elſewhere, and alſo in the Ruins of the Amphitheatre at *Niſmes*, where the Joints of the Stone are perfectly free from Mortar; as alſo in the Vaulting of the *Temple of Diana* at the ſame Place: But theſe Examples are not always to be regarded or followed, and eſpecially where the Smallneſs of your Materials (ſuch as Bricks) do abſolutely require to be firmly bound with Mortar to ſtrengthen the Work, and to enable it to ſtand.

2. It will be neceſſary that you ſhould be well enough acquainted with Statics, to know, that whatever turns upon an Axis after the Manner of the Scales of a Ballance, whoſe Brachia are either equal or unequal, will never be in Æquilibrio with another Body, if that Body be not of equal Weight with the Body at firſt propoſed, or if by a reciprocal Diſtance from the Center or Axis, it be not brought to have a Preſſure downwards to counter-balance the Preſſure of its oppoſite Weight: By a Knowledge of this we provide againſt the Puſh or Impulſion of Arches, by keeping them within due Bounds, by the Aſſiſtance of the Force of a Power equal to their Puſh or Effort to ſpread or part aſunder.

3. You are to have Recourſe to Mechanics, to judge of the Strength of all theſe Bodies, and the Power of moving Forces, and in what Reſpect, and after what Manner, thoſe Bodies which are ſupported or born up in the Air, act upon thoſe that are fixed upon Earth, and which are look'd upon as immoveable; ſuch as the Arch of a Bridge or a Vault, which have very various Powers upon the Butments and Peers which ſupport them, and which are ſuppoſed to be immoveable; and upon this Account a Knowledge of Stone-cutting is neceſſary, by which you may determine the ſeveral Powers of the Vouſſoirs, one upon another; for there is no Vouſſoir which being differently inclined (tho' it may be cut by the very ſame Moulds) but what acts in a Manner peculiar to itſelf upon thoſe upon which it is placed, or upon thoſe which are placed over it; ſo that they all act differently, according to the different Inclination of their Planes.

4. Geometry will be very neceſſary for the right Underſtanding of theſe five Propoſitions, that you may be able to determine or calculate the Surfaces and ſolid Content of theſe Bodies in queſtion, thereby to come at their Powers, and to compare them with one another. A ſmall Portion of theſe above ſpecified Sciences acting in Concert with common Senſe, will be ſufficient for the clear conceiving of what I ſhall here advance. I ſhall omit nothing that can contribute to render what I have to ſay plain and intelligible to Perſons of the meaneſt Capacity, for whom alone I have undertaken this Task.

If we examine the firſt Fig. in Plate 1. we ſhall ſee that A M is the Diameter of a Semi-circular Arch, A E M; or it may be Flat, Gothic, or any other that you pleaſe, whoſe Puſh you are deſirous to know, in order to proportion a Butment to it, or a Power equal to it.

Continue the Diameter M A indefinitely and upon a Level towards C;

Raiſe the Perpendicular A D indefinitely upon the Foot of the Arch A, whoſe Point A muſt be look'd upon as immoveable:

Then from the Point of Support, or the Foot of the Arch A, to the Middle of the Bottom of the Key, produce the Line A E, and from the aforeſaid Point of Support A, with the Opening A E, deſcribe the Quadrant D E B, which will interſect the Line A M in the Point B, and A D indefinitely in D: Now it is certain that A B, A E, and A D, are equal in this Caſe, as they are all *Radii*, of one and the ſame Circle, produce A C alſo equal to A B.

Then produce the Hypothenuſe B D, which ſhall interſect A E in the Point I.

From the Point I, let fall the Perpendicular I L upon A D, which will be the Half of A B.

From the Summit or Top E, produce indefinitely the Line E G parallel to B C, which will interſect A D in H, and ſet off the Line I L from H to G, which will ſerve for a Butment to the Arch A E M, by letting fall the Perpendicular G V.

Demonſtration.

1. If you examine the Diſpoſition of this Figure, you will find that C B being upon a Level, and A B being conſidered as the Half of the Plate-band or Face of a Beam, *&c.* it could not remain in that Poſture if it was not counterbalanced by A C, which is equal and oppoſite to it, on the other Side of the Point of Suſpenſion or Support A, which is immoveable. Now A C is equal to A B, whether in Length, in Power, or in Weight, then A C muſt æquiponderate, or be in Æquilibrio with A B. Let us here ſuppoſe A B to have a Force of 90 Degrees, thereby the better to illuſtrate our Demonſtration, and make it familiar to every Body.

2. But this Half of the Plate-band or Beam A B, is raiſed perpendicularly upon itſelf in the Point of Support A, as may be obſerved in A D; ſo that neither leaning to the one Side nor the other, it can have no Power nor Preſſure towards B or C, as it had before; ſo that there is no Need of any thing to keep it in Æquilibrio, for the Point of Support A is ſufficient for that, inaſmuch as we here ſuppoſe it to be immoveable; and thus the Plate-band or Beam A B, perpendicularly placed in A D, will have no Force, which we will expreſs by a Cypher, inſtead of having a Force, which we have here called 90 Degrees, when its Direction was Horizontal, as A B.

In ſhort, this ſame Plate-band or Beam A B, whoſe Force is 90 Degrees, being placed in A E with an Inclination of 45 Degrees, between A D 00 and A B 90, it is certain that its Power will be mixed; or, to ſpeak plainer, it will be in a mean Proportion between A B and A D; ſo that if the firſt has a Puſh or Force of 90 Degrees, and the Force of the other is 00, A E will obſerve a Medium between them, and conſequently will have but a Force of 45; and thus the Half of A B, which is A N, will be ſufficient to counterbalance it, which is the ſame with I L or H G, which will be able to counterbalance A E, which was to be proved; ſo that A B the Half of the Plate-band or Beam, whoſe Force is 90 Degrees, being to A D 00, as I L the Half of A B, whoſe Force is 45, is to L D 00; and in a reciprocal Proportion to each other, the Puſh A E of the Arch A E M will be H G, as that of the Plate-band A B will be A C, which was to be demonſtrated.

Thus you are to proceed in inveſtigating the Puſhes of the Scheam Arches which are leſs than a Semi-circle, as well as thoſe of Gothic Arches which are more, by comparing an Arch of any Sort with the Demonſtration here laid down with relation to a Semi-circular Arch, whoſe Puſh is always determined by the Line B D, and in this is equal to I L.

From what we have ſaid above, it will be evident that M R which is the Butment, according to the Method of Father *Deran* and Mr. *Blondell*, is widely different from A V, which we have juſt now demonſtrated to be its proper Butment.

That if the Arch A E M was converted into a Plate-band or Strait-Arch A M, the Half of it A F would be counterbalanced by A I or A T, which is equal to it.

I apprehend that the meereſt Smatterers in Geometry, ſuch as the greateſt Part of Maſter Maſons and Stone-cutters are, will underſtand what I have been ſaying, and be able to to trace it out, and demonſtrate it to their own Satisfaction.

Of the Strait-Arch.

Fig. 2. Let G A and H C be the Sides of the Walls of the Butments, or rather of the Pied droits which are to ſuſtain a Strait-Arch.

Let A C be the Space betwixt the Walls, which alſo will be the Length of the Strait-Arch, and which we will ſuppoſe to be 10 Foot, or 10 Fathoms, or any Meaſure elſe you pleaſe.

Draw the Line C A, and with the opening of the Compaſſes A C, conſtitute the Equilateral Triangle A F C, and from the Point F, with the ſame opening of the Compaſſes F A, deſcribe the Segment of a Circle A E C, which ſhall be biſected equally in E, upon the aforeſaid Segment A E C; the Height B E, which is about $\frac{1}{8}$ of A C, will give the Height of the Strait-Arch for ſquaring or cutting of the Stones which are to compoſe it.

Then continue CA to D, ſo that AD may be equal to B A the Half of A C; now it muſt be evident, that the Puſh, Preſſure, or Impulſion of A B being equal to the Reſiſtance or Force of D A, the Strait-Arch cannot ſhove or puſh the Wall G D beyond the Axis G A, and thus A D will be the Thickneſs of the Pied droit, or of the Walls which are to ſuſtain the Impulſion or Puſh of the Strait-Arch, which is indeed more frequently uſed in Civil Structures, to ſupport Platforms, Ceilings, or Roofs of Galleries, or other Paſſages, a-croſs a Court, and in Churches to ſerve for Tribunes, than for Bridges. There is a very fine one in the Church of the Reverend Jeſuits of *Niſmes*, which was conſtructed by the Direction of the late Father *Mourgues*, and after the Deſign of the late Sieur *Cubiſol*, who was a very skilful Architect, to which he gave leſs Height at B E, than what we allow here; whether it was that he was aſſured of Soundneſs or Solidity of the Stones, or the Truth of the Works, *&c.* As his Deſign is perfectly bold, I ſhall here give ſome Account of it.

The Strait-Arch we are here ſpeaking of is 4 Fathoms, 2 Foot, and 6 Inches in Length, the Stones of it are 1 Foot in Thickneſs, their Height B E is 2 Foot towards the Key, and at each End A G, C H, they begin with 2 Foot 4 Inches. This Strait-Arch had a Riſe about 6 or 7 Inches, when its Stones were ſet together upon the Center; but it afterwards ſunk down 3 Inches when its Joints came to ſettle, upon the taking away of the Centering or Stay; ſo that at this Day it riſes about 4 Inches above B.

The Practice of this ſort of Work, and a Knowledge of the Soundneſs or Hardneſs of Stone, are what muſt guide you in regulating the Height B E, but for want of ſufficient Experiments we are ſtill in the Dark as to this Matter. The skilful Architect muſt do in this according to the beſt of his Knowledge; if he ſucceeds he will be eſteemed and applauded; but if he fails, he is deſpiſed and laughed at.

However, by repeated Experiments and Proofs of the Conſiſtence of Stones, it would not be impoſſible to aſcertain ſome ſure Rules with regard to this Matter; for it is of the greateſt Importance to know the different Solidity and Firmneſs of Stones and other Bodies, which vary conſiderably, according to their ſeveral Climates and Grains, that we may be able to proportion their Subſtance to the Efforts, Preſſures, or Puſhes of Strait-Arches, or others; which being once calculated (*viz.*) the Weights of the Efforts of the Bodies which the Haunſes of the Platebands, or the Vouſſoirs of Arches, are to ſuſtain, we may examine the Strength of Stones you are to uſe, by taking a Piece of them of a Cubical Inch in Dimenſion, that is, in Form of a Die, and by loading it with Weights till it diſperſes and yields to the Preſſure of its ſuperincumbent Burthen, from whence ſome certain Rules may be eſtabliſhed with regard to this Matter. Thus, if ſuch a Cube of Stone as we have mentioned ſupports a Weight which is a Thouſand or a Million of Times heavier and bigger than itſelf, we will allow it but $\frac{1}{4}$ of that Reſiſtance or Force when we come to apply it to the Building of our Works, whether they be Piers of Bridges, which are to ſuſtain the greateſt Burthens, or whether they be Vouſſoirs of Vaults or the Archivolts of Bridges, which are the Parts that give or exert the greateſt Effort or Puſh, as well as Stones of Strait-Arches, whether they are to ſupport Towers or Steeples, *&c.* Thus I allow $\frac{3}{4}$ of the Strength of theſe Bodies to make amends for the Imperfections of the Work; for there is no Man whatever, who can ſet or join them together in any Building, with that exact Arrangement in which they were placed by Nature in the Beds or Strata or the Quarries from whence they were raiſed. Clumſy Joints, ſtuffed up with Mortar and Shells, which do not bear throughout equally, and conſequently yield to the Preſſure of the ſuperincumbent Weight, is the Reaſon why Buildings ſplit and ſettle from the Difference of the Binding, which is not equally firm in all its Parts, from whence ariſe very diſagreeable Deformities and Eye-Sores, as well as very prejudicial Accidents to the Work itſelf.

The Joints between B and C of the Strait-Arch are indented, which are ſometimes ordered after a different Manner; for there are thoſe who like a plain uniform Joint the beſt, ſuch as you ſee between B and A; but this depends upon the Skill, or at leaſt the Fancy, of the Architect: For the more complex Joints are (ſay ſome) the more confuſed, and the more ſubject to Defects; but the more ſimple and plain they are, the truer and ſtronger is the Work, as thoſe Joints between A and B, which are plain.

What I have here offered by way of diſcovering the ſeveral Degrees of the Strength and Solidity of Materials, is ſomething like the Experiment made by the Gentlemen of the Royal Academy of Sciences at *Paris*, upon a twiſted Cord compoſed of 20 Yarns or Threads, each of theſe Yarns, when ſingle, were capable of ſuſtaining 1 ℔ Weight without breaking; but being twiſted together, and converted into a Cord, they could not bear up a Weight of 20 ℔, for it broke with a Weight of between 16 and 18 ℔; for it is impoſſible for human Art to twiſt theſe 20 Yarns ſo nicely together, as that all of them ſhall ſuſtain an equal Share of the Burthen ſuſpended by them when in a Cord; ſo that ſome of them being loaded with a Weight ſuperior to their Strength, and ſome with a Weight inferior to their Strength, they are all in general unequally or diſproportionably laden, from whence it muſt appear that they muſt be unable to bear the Weight of the 20 ℔ before mentioned. Thus ſuppoſing a Cubical Inch of Stone to be able to bear 100℔, it would not from thence follow that ten ſuch Cubes would ſuſtain a Burthen of 1000 ℔, becauſe a Maſs or Body of that Weight would not bear alike upon all the 10; wherefore ſome of them being more heavily laden than others, they would all be cruſhed, one after another, from whence happens the flying or breaking of the Stones of an Archivolt, and of all Bodies which are not preſs'd upon equally throughout the whole Plane of their Superficies.

What Proportion the Piers and Pilaſters ought to bear to the Apertures or Lights of the Arches, and of the Weights they are laden by, ſee the following Table.

A TABLE of the Principal Parts of BRIDGES,

Apert. of the Arch.	Piers.		Piles.		Vouſſoirs of Hard ſtone		Vouſſoirs of Free ſtone	
Foot.	*F.*	*In.*	*F.*	*In.*	*F.*	*In.*	*F.*	*In.*
1	2	$6\frac{1}{2}$	1	6	1	—$\frac{1}{2}$	1	6
2	2	9	1	8	1	1	1	$7\frac{1}{6}$
3	2	$11\frac{1}{2}$	1	10	1	$1\frac{1}{2}$	1	$8\frac{1}{3}$
4	3	2	2	—	1	2	1	$9\frac{1}{2}$
5	3	$4\frac{1}{2}$	2	2	1	$2\frac{1}{2}$	1	$10\frac{2}{3}$
6	3	7	2	4	1	3	2	—
7	3	$9\frac{1}{2}$	2	6	1	$3\frac{1}{2}$	2	—$\frac{2}{3}$
8	4	—	2	8	1	4	2	$1\frac{1}{2}$
9	4	$2\frac{1}{2}$	2	10	1	$4\frac{1}{2}$	2	$2\frac{1}{4}$
10	4	5	3	—	1	5	2	3
11	4	$6\frac{3}{4}$	3	$1\frac{1}{4}$	1	$5\frac{1}{2}$	2	4
12	4	$8\frac{1}{2}$	3	$2\frac{1}{2}$	1	6	2	$4\frac{1}{2}$
13	4	$9\frac{3}{4}$	3	$3\frac{3}{4}$	1	$6\frac{1}{2}$	2	5
14	5	—	3	5	1	7	2	6
15	5	$1\frac{3}{4}$	3	$6\frac{1}{4}$	1	$7\frac{1}{2}$	2	$6\frac{3}{4}$
16	5	$3\frac{1}{2}$	3	$7\frac{1}{2}$	1	8	2	7
17	5	$5\frac{1}{4}$	3	$8\frac{3}{4}$	1	$8\frac{1}{2}$	2	8
18	5	6	3	9	1	9	2	9
19	5	$7\frac{3}{4}$	3	$10\frac{1}{4}$	1	$9\frac{1}{2}$	2	$9\frac{1}{4}$
20	5	10	4	—	1	10	2	$9\frac{1}{2}$
21	6	—$\frac{11}{12}$	4	$2\frac{5}{12}$	1	$10\frac{1}{2}$	2	$9\frac{3}{4}$
22	6	4	4	5	1	11	2	10
23	6	$6\frac{1}{2}$	4	7	1	$11\frac{1}{2}$	2	$10\frac{1}{4}$
24	6	$9\frac{7}{12}$	4	$9\frac{7}{12}$	2	—	2	$10\frac{1}{2}$
25	7	—$\frac{1}{2}$	5	—	2	—$\frac{1}{2}$	2	$10\frac{3}{4}$
26	7	$3\frac{5}{12}$	5	$2\frac{5}{12}$	2	1	2	11
27	7	$6\frac{1}{2}$	5	5	2	$1\frac{1}{2}$	2	$11\frac{1}{4}$
28	7	9	5	7	2	2	2	$11\frac{1}{2}$
29	7	$11\frac{7}{12}$	5	$9\frac{7}{12}$	2	$2\frac{1}{2}$	2	$11\frac{3}{4}$
30	8	3	6	—	2	3	3	—
31	8	$5\frac{11}{12}$	6	$2\frac{5}{12}$	2	$3\frac{1}{2}$	3	—$\frac{5}{6}$
32	8	9	6	5	2	4	3	$1\frac{2}{3}$
33	8	11	6	7	2	$4\frac{1}{2}$	3	$2\frac{1}{2}$
34	9	$2\frac{7}{12}$	6	$9\frac{7}{12}$	2	5	3	3
35	9	$5\frac{1}{2}$	7	—	2	$5\frac{1}{2}$	3	$3\frac{5}{6}$
36	9	$6\frac{1}{2}$	7	$2\frac{1}{2}$	2	6	3	4
37	9	$9\frac{1}{2}$	7	5	2	$6\frac{1}{2}$	3	$4\frac{1}{2}$
38	10	—	7	7	2	7	3	5
39	10	$3\frac{1}{12}$	7	$9\frac{7}{12}$	2	$7\frac{1}{2}$	3	$5\frac{1}{2}$
40	10	8	8	—	2	8	3	8
41	10	$11\frac{1}{4}$	8	$2\frac{5}{12}$	2	$8\frac{5}{6}$	3	$8\frac{5}{6}$
42	11	$2\frac{2}{3}$	8	5	2	$9\frac{2}{3}$	3	$9\frac{2}{3}$
43	11	$5\frac{1}{2}$	8	7	2	$10\frac{1}{2}$	3	$10\frac{1}{2}$
44	11	$8\frac{11}{12}$	8	$9\frac{7}{12}$	2	$11\frac{1}{3}$	3	$11\frac{1}{3}$
45	12	—	9	—	3	—	4	—
46	12	$3\frac{1}{4}$	9	$2\frac{5}{12}$	3	—$\frac{5}{6}$	4	—$\frac{5}{6}$
47	12	$6\frac{2}{3}$	9	5	3	$1\frac{2}{3}$	4	$1\frac{2}{3}$
48	12	10	9	7	3	$2\frac{1}{2}$	4	$2\frac{1}{2}$
49	13	—$\frac{11}{12}$	9	$9\frac{7}{12}$	3	$3\frac{1}{3}$	4	3
50	13	4	10	—	3	4	4	$3\frac{5}{6}$
51	13	$7\frac{1}{4}$	10	$2\frac{5}{12}$	3	$4\frac{5}{6}$	4	$4\frac{2}{3}$
52	13	$10\frac{2}{3}$	10	5	3	$5\frac{2}{3}$	4	$5\frac{1}{2}$
53	14	$1\frac{1}{2}$	10	7	3	$6\frac{1}{2}$	4	$6\frac{1}{3}$
54	14	$4\frac{11}{12}$	10	$9\frac{7}{12}$	3	$7\frac{1}{3}$	4	$7\frac{1}{6}$
55	14	8	11	—	3	8	4	8
56	14	$11\frac{1}{4}$	11	$2\frac{5}{12}$	3	$8\frac{5}{6}$	4	$8\frac{5}{6}$
57	15	$2\frac{2}{3}$	11	5	3	$9\frac{2}{3}$	4	$9\frac{7}{12}$
58	15	$5\frac{1}{2}$	11	7	3	$10\frac{1}{2}$	4	$10\frac{1}{4}$
59	15	$8\frac{11}{12}$	11	$9\frac{7}{12}$	3	$11\frac{1}{3}$	4	$11\frac{1}{6}$
60	16	—	12	—	4	—	5	—

The foregoing Table gives the Proportions of the Length of the Vouſſoirs, or the Height of the Archivolts, as well as can be gather'd and aſcertain'd from the beſt Authors, and Works of Antiquity, which cannot be reduced to an exact Geometrical Demonſtration, and has been purely calculated from Experience of the more ſolid or courſe Conſiſtence of Stones, upon which Point this whole Article turns. That Phyſics bear a greater Share in this, than either Mechanicks or Geometry.

Experiment.

In order to be fully confirmed in what I have here advanced concerning the Puſh or Preſſure of Arches and Vaults, as alſo of the Length of Vouſſoirs, or the Height of Archivolts, I had Recourſe to the following Experiment.

I got a ſmall Semi-Arch of 10 certain Meaſures in Diameter, and Semi-circular, as in the above Table. This Semi-Arch I compoſed of 9 Vouſſoirs (ſee Fig. 31. A B, C D, Plate II.) which were made of Wood, and turn'd it up againſt a Wall in A B E, as againſt an immovable Key upon the Half Centre B C E.

Thus having plac'd the 9 Vouſſoirs C B, upon the Half Centre C B, I loaded them behind with other Pieces of Wood, equal to them in Bulk, and alike in Weight, I plac'd nine more upon one another, after the Manner you may ſee in the Figure, by F G, and behind them I ranged the four others, at I: This done, I uncentered the Semi-Arch E B C, and it remained immovable in the Poſition, you ſee it in the Figure.

I afterwards took away the Pieces of Wood which form the Butment, and keep in the Reins or Sides of the Arch, one after another, according to the Numbers, 9, 8, 7, 6, 5, 1, 13, 4, 12, 3, ſo that there remained but the four undermoſt, *viz.* 11, 2, 10, 1; which four ſupported the Semi-Arch

from an Arch of 1 Foot, to that of 120 Foot Aperture.

Apert. of the Arch.	Piers.		Piles.		Vouſſoirs of Hardſtone		Vouſſoirs of Free ſtone	
Foot.	*F.*	*In.*	*F.*	*In.*	*F.*	*In.*	*F.*	*In.*
61	16	$3\frac{1}{4}$	12	$2\frac{5}{12}$	4	— $\frac{5}{6}$	5	— $\frac{5}{6}$
62	16	$6\frac{2}{3}$	12	5	4	$1\frac{2}{3}$	5	$1\frac{2}{3}$
63	16	$9\frac{1}{2}$	12	7	4	$2\frac{1}{2}$	5	$2\frac{1}{2}$
64	17	— $\frac{11}{12}$	12	$9\frac{7}{12}$	4	$3\frac{1}{3}$	5	3
65	17	4	13	—	4	4	5	$3\frac{5}{6}$
66	17	$7\frac{1}{4}$	13	$2\frac{5}{12}$	4	$4\frac{5}{6}$	5	$4\frac{2}{3}$
67	17	$10\frac{2}{3}$	13	5	4	$5\frac{2}{3}$	5	$5\frac{1}{2}$
68	18	$1\frac{1}{2}$	13	7	4	$6\frac{1}{2}$	5	$6\frac{1}{3}$
69	18	$3\frac{11}{12}$	13	$9\frac{7}{12}$	4	$7\frac{1}{3}$	5	$7\frac{1}{6}$
70	18	6	14	—	4	8	5	8
71	18	$11\frac{1}{4}$	14	$2\frac{5}{12}$	4	$8\frac{5}{6}$	5	$8\frac{5}{6}$
72	19	$3\frac{2}{3}$	14	5	4	$9\frac{2}{3}$	5	$9\frac{7}{12}$
73	19	$5\frac{1}{2}$	14	7	4	$10\frac{1}{2}$	5	$10\frac{1}{4}$
74	19	$8\frac{11}{12}$	14	$9\frac{7}{12}$	4	$11\frac{1}{3}$	5	$11\frac{1}{6}$
75	20	—	15	—	5	—	6	—
76	20	$3\frac{1}{4}$	15	$2\frac{5}{12}$	5	— $\frac{5}{6}$	6	— $\frac{5}{6}$
77	20	$6\frac{2}{3}$	15	5	5	$1\frac{2}{3}$	6	$1\frac{2}{3}$
78	20	$9\frac{1}{2}$	15	7	5	$2\frac{1}{2}$	6	$2\frac{1}{2}$
79	21	— $\frac{11}{12}$	15	$9\frac{7}{12}$	5	$3\frac{1}{3}$	6	3
80	21	4	16	—	5	4	6	$3\frac{5}{6}$
81	21	$7\frac{1}{4}$	16	$2\frac{5}{12}$	5	$4\frac{5}{6}$	6	$4\frac{2}{3}$
82	21	$10\frac{2}{3}$	16	5	5	$5\frac{2}{3}$	6	$5\frac{1}{2}$
83	22	$1\frac{1}{2}$	16	7	5	$6\frac{1}{2}$	6	$6\frac{1}{3}$
84	22	$4\frac{11}{12}$	16	$9\frac{7}{12}$	5	$7\frac{1}{3}$	6	$7\frac{1}{6}$
85	22	8	17	—	5	8	6	8
86	22	$11\frac{1}{4}$	17	$2\frac{5}{12}$	5	$8\frac{5}{6}$	6	$8\frac{5}{6}$
87	23	$2\frac{2}{3}$	17	5	5	$9\frac{2}{3}$	6	$9\frac{7}{12}$
88	23	5	17	7	5	$10\frac{1}{2}$	6	$10\frac{1}{4}$
89	23	$8\frac{11}{12}$	17	$9\frac{7}{12}$	5	$11\frac{1}{3}$	6	$11\frac{1}{6}$
90	24	—	18	—	6	—	7	—
91	24	$3\frac{1}{4}$	18	$2\frac{5}{12}$	6	— $\frac{5}{6}$	7	— $\frac{5}{6}$
92	24	$6\frac{2}{3}$	18	5	6	$1\frac{2}{3}$	7	$1\frac{2}{3}$
93	24	$9\frac{1}{2}$	18	7	6	$2\frac{1}{2}$	72	$\frac{1}{2}$
94	25	— $\frac{11}{12}$	18	$9\frac{7}{12}$	6	$3\frac{1}{3}$	7	3
95	25	4	19	—	6	4	7	$3\frac{5}{6}$
96	25	$7\frac{1}{4}$	19	$2\frac{5}{12}$	6	$4\frac{5}{6}$	7	$4\frac{2}{3}$
97	25	$10\frac{2}{3}$	19	5	6	$5\frac{2}{3}$	7	$5\frac{1}{2}$
98	26	$1\frac{1}{2}$	19	7	6	$6\frac{1}{2}$	7	$6\frac{1}{3}$
99	26	$4\frac{11}{12}$	19	$9\frac{7}{12}$	6	$7\frac{1}{3}$	7	$7\frac{1}{6}$
100	26	8	20	—	6	8	7	8
101	26	$11\frac{1}{4}$	20	$2\frac{5}{12}$	6	$8\frac{5}{6}$	7	$8\frac{5}{6}$
102	27	$2\frac{2}{3}$	20	5	6	$9\frac{2}{3}$	7	$9\frac{7}{12}$
103	27	$5\frac{1}{2}$	20	7	6	$10\frac{1}{2}$	7	$10\frac{1}{4}$
104	27	$8\frac{11}{12}$	20	$9\frac{7}{12}$	6	$11\frac{1}{3}$	7	$11\frac{1}{6}$
105	28	—	21	—	7	—	8	—
106	28	$3\frac{1}{4}$	21	$2\frac{5}{12}$	7	— $\frac{5}{6}$	8	— $\frac{5}{6}$
107	28	$6\frac{2}{3}$	21	5	7	$1\frac{2}{3}$	8	$1\frac{2}{3}$
108	28	$9\frac{1}{2}$	21	7	7	$2\frac{1}{2}$	8	$2\frac{1}{2}$
109	29	— $\frac{11}{12}$	21	$9\frac{7}{12}$	7	$3\frac{1}{3}$	8	3
110	29	4	22	—	7	4	8	$3\frac{5}{6}$
111	29	$7\frac{1}{4}$	22	$2\frac{5}{12}$	7	$4\frac{5}{6}$	8	$4\frac{2}{3}$
112	29	$10\frac{2}{3}$	22	5	7	$5\frac{2}{3}$	8	$5\frac{1}{2}$
113	30	$1\frac{1}{2}$	22	7	7	$6\frac{1}{2}$	8	$6\frac{1}{3}$
114	30	$4\frac{11}{12}$	22	$9\frac{7}{12}$	7	$7\frac{1}{3}$	8	$7\frac{1}{6}$
115	30	8	23	—	7	8	8	8
116	30	$11\frac{2}{8}$	23	$2\frac{5}{12}$	7	$8\frac{5}{6}$	8	$8\frac{5}{6}$
117	31	$2\frac{2}{3}$	23	5	7	$9\frac{2}{3}$	8	$9\frac{7}{12}$
118	31	$5\frac{1}{2}$	23	7	7	$10\frac{1}{2}$	8	$10\frac{1}{4}$
119	31	$8\frac{11}{12}$	23	$9\frac{7}{12}$	7	$11\frac{1}{3}$	8	$11\frac{1}{6}$
120	32	—	24	—	8	—	9	—

A B C D: but as ſoon as I began to remove the 11, the Vouſſoirs fell aſunder.

This Experiment gave me to underſtand, in the firſt Place, That the Maſs of Stone-Work, which the Sides or Declivity of Vaults are laden by, ſerve them for a Support to keep the Vouſſoirs in Æquilibrio, that they may not deviate or depart from the Curve form'd by their Centre, and likewiſe, that their ſtrongeſt Puſh is in that Place.

Secondly, The Experiment was made with Pieces of Wood (which conſequently were very light) that had nothing between their Joints to keep them together; they nevertheleſs kept each other up, by Means of their Mould or Cut, which I had given to a Joiner to make them by.

Thirdly, This Experiment confirms me in Opinion, that if we made our Archivolts without any Mortar, Cement, or Cramps, in Imitation of the Ancients, and afterwards ran a kind of fine Mortar or Cement, made of Pulverized Stone, into the ſeveral Abreuvoirs, the Work would be much more durable than it can be with thick Beds of Mortar, which yield to the immenſe Weight of the ſuperincumbent Stones.

Fourthly, From the Foot of the Semi-Arch having rais'd the Perpendicular C K, I found that the Vouſſoirs B C, which are interſected by the Line C K, never attempted to fall aſunder till the Part of the Butment C K was made lighter than the Part of the Semi-Arch C B; which confirms what I ſaid before. Thus the Vouſſoirs, together with the Materials they are laden with, ought to be in Æquilibrio with the Butment which you would have to reſiſt their Puſh, or the Work muſt infallibly fall to Pieces.

I have calculated the above Table, in order to make theſe Things familiar to Perſons who are ignorant of Geometry.

Which of the ſeveral Sorts of Arches, fixed or erected upon one and the ſame Diameter, would be capable of ſuſtaining the greateſt Weight, and in what Proportion their Efforts or Puſhes are to one another, whether they be Sceam Elliptick, Semi-Circular, or, in ſhort, of the third Point or Gothic.

If due Attention be given to what I have already laid down, it may be allowed, that the Puſhes of all Arches of different Degrees of Flatneſs, are to the Weight by which they are laden, as their ſeveral Degrees of Inclinations are to the Breadth of the Butment, which is to ſecure them; and it will alſo be found, that thoſe whoſe Puſh is the leaſt inclined (or oblique) will be able to ſuſtain greater Burthens than thoſe which border upon the Strait-Arch, which is the weakeſt of all.

Let us ſuppoſe the Strait-Arch C A, Fig. 30. Plate II. to be a Beam tranſported or removed to A C, Fig. 32. Now it is certain, that if in this Situation it was laden with a Weight of 100, and it ſhould happen to break, it would, nevertheleſs, be able to bear, not only a Weight of 100, but alſo a Weight infinitely greater, if it was raiſed perpendicularly, as A B.

But I ſhall put the Caſe here, that it would bear 200, and therefore 150 being the mean Proportional between 100 and 200, or between the firſt Puſh (as we will call it) and the ſecond, it will be found, that the Beam being elevated to 45 Degrees in A D, it will bear that Weight (*viz.*) 150, to form a Semi-circular Arch. If you lower it down to A F, to form an Elliptical Arch, it will be found, that if you take the mean Proportional between the Semi-circular Arch A D, and the Beam (or Strait-Arch) A C, the Ellipſis will bear but 125; in ſhort, the mean Proportional between the Semi-circular Arch, which is 150, and the Power or Force of A B 200, will be 175, and that will expreſs the Strength of the Gothic Arch A E. Thus the higher an Arch is carried up, the ſtronger will it be; and the flatter or lower it is, the weaker. This Article may be determined to the niceſt Exactneſs, when you ſhall have diſcovered or agreed upon the Difference of the Strength of a Beam, when laid down like a Strait-Arch, as A C, and when erected perpendicularly, A B.

From this Demonſtration we infer, That the Gothic Arch is ſtronger than the Semi-circular, the Semi-circular Arch ſtronger than the Elliptical, and this laſt than the Strait-Arch.

Fig. 32. in Plate II. helped me to make an Experiment whereby to find the Weights of all Sorts of Bodies, at different Inclinations, as may be learned from the following Paragraph.

Paragraph.

Of the Weight of Bodies at different Inclinations, and the Manner of calculating it.

A Body A B (Plate II. Fig. 32.) uniform throughout its whole Length and Thickneſs, no matter whether round or ſquare, weighed 100 upon the Point of Support A, or upon itſelf when erected perpendicularly, as A B.

But when this ſame Body A B, was laid down horizontally, or on a Level, upon the Points A and C, which were equidiſtant from the Centre or Middle of it, it preſſed upon the Point A, with a Weight of 50 only; becauſe, as the whole Weight is equally ſupported by the Points A and C, the whole Weight aforeſaid is equally divided between them, thus, as it bears 50 upon A, and 50 upon C, the Sum of thoſe two Numbers is 100, the whole Weight.

When I altered the Poſition of this Body A C, by giving it an Elevation of 45 Degrees in A D, I found that it preſſed upon D with a Weight of 25 only; wherefore it muſt preſs upon A with a Weight of 75, inaſmuch as the Sum of thoſe two Numbers gives 100, the whole Weight which was to be found.

I then made two other Experiments, by elevateing the aforeſaid Body from A D to 67½ in E, by depreſſing or declining to 22½ Degrees, in F; upon the Point E it preſſed with a Weight of 12½ only, and upon the Point F, with a Weight of 37½; and conſequently, I found that E A, at an Elevation of 67°, 30′, preſſing after the Rate of 12½ only upon the Point E, muſt preſs with a Weight of 87½ upon its Point A; and alſo, that A F, at an Elevation of 22°, 30′, muſt preſs upon its Point A with a Weight of 62½; and thus you will find it in continued Proportion, by ſubdividing the Parts, B E, E D, D F, and F C: From hence I calculated a Table, which ſhews, that the Body A B preſſes the greater upon its Point of Support A, the higher it is elevated above the Level A C; and inverſely, that the aforeſaid Point of Support is the leaſt preſſed the more the Body A B is inclined towards C, and ſo on beneath the Level A C, by a reverſe Poſition indeed, but however, in the very ſame Proportion.

In order to this, I have ſuppoſed the Body A B, to be uniform throughout its whole Dimenſions, and to weigh 100 (no matter whether Pounds or any other Weights) and to be 100 equal Parts in Length.

Having laid down this for a Foundation, I found no Difficulty in inveſtigating the Effort and Power of all Bodies whatſoever, more or leſs inclined, whether in a Strait Line or a Curve; for by reduceing the Curves to Strait Lines, or at leaſt, by ſuppoſing the Curves to be equally ſupported by the Extremities of their Chords, and by comparing the Chords with one another, I reſolve the Strength and Weight of all Arches and Vaults, of whatſoever Figure they be, whether regular or irregular, as I ſhall now demonſtrate.

But you muſt previouſly conſult the following Table, where it will be ſeen, that the firſt Column contains the various Degrees of the Inclination of Bodies whoſe Weight we would calculate. You ſhall again ſuppoſe the Body to weigh 100 ℔ (or any thing elſe) or any other Number which anſwers to the equal Parts into which it is divided, and the Inclination of the Body ſhall be determined by a certain Number of Degrees.

This being premiſed, let there be an Arch of any other inclined Body, whoſe Weight or Preſſure at the Key you would know. Let us ſuppoſe it to be the Half of the Semi-circular Arch, (Fig. 29. Plate II.) whoſe Preſſure or Weight you would know at the Key E; calculate the Weight of the Stone or Brick-Work, E H A, of the Semi-Arch, which you may eaſily do, by a previous Knowledge of the Weight of a Cubic Foot of either of thoſe Materials: For ſuppoſe that E H A weighs 9750 ℔, the ½ of which will be 4875 ℔, but the Chord of the Semi-Arch is at an Inclination of 45°; therefore (from the Table beneath) ſay, If 50, the laſt Number or Term, gives the Weight of 25 at an Inclination of 45°, how much will 4875, the Half of the Weight of the whole Triangle A H E, give, and it will come out 2437½; ſo that the Body E H A, weighing in all 9750, will weigh at the Key, at an Inclination of 45°, $2437\frac{1}{2}$, which laſt Number being ſubtracted from 9750, it will be found to weigh, or to puſh at the Foot or Couſnet $7312\frac{1}{2}$. It is after this Manner that you are to determine with regard to the Strength of Buttreſſes for the Support of Vaults, Walls, *&c.*

From hence we conclude that the Key E of the Arch being preſſed on one Side by a Weight of $2437\frac{1}{2}$, and as much on the other, the Solidity or Strength ought to be able to reſiſt a Weight of 4874. It is in Caſes of this Kind that the above Rule may be of conſiderable Service.

A TABLE *of the Proportion of the Weight or Preſſure of Regular Bodies, at all Degrees of Inclination.*

Degr. of Incl.	℔.	*oz.*	Degr. of Incl.	℔.	*oz.*	Degr. of Incl.	℔.	*oz.*
1	0	$8\frac{8}{9}$	31	17	$0\frac{2}{9}$	61	33	$0\frac{8}{9}$
2	1	$0\frac{1}{9}$	32	17	$0\frac{7}{9}$	62	34	$0\frac{4}{9}$
3	1	$0\frac{6}{9}$	33	18	$0\frac{3}{9}$	63	35	0
4	2	$0\frac{2}{9}$	34	18	$0\frac{8}{9}$	64	35	$0\frac{5}{9}$
5	2	$0\frac{7}{9}$	35	19	$0\frac{4}{9}$	65	36	$0\frac{1}{9}$
6	3	$0\frac{6}{9}$	36	20	0	66	36	$0\frac{6}{9}$
7	3	$0\frac{8}{9}$	37	20	$0\frac{5}{9}$	67	37	$0\frac{2}{9}$
8	4	$0\frac{4}{9}$	38	21	$0\frac{1}{9}$	68	37	$0\frac{7}{9}$
9	5	0	39	21	$0\frac{6}{9}$	69	38	$0\frac{3}{9}$
10	5	$0\frac{5}{9}$	40	22	$0\frac{2}{9}$	70	38	$0\frac{8}{9}$
11	6	$0\frac{1}{9}$	41	22	$0\frac{7}{9}$	71	39	$0\frac{4}{9}$
12	6	$0\frac{6}{9}$	42	23	$0\frac{3}{9}$	72	40	0
13	7	$0\frac{2}{9}$	43	23	$0\frac{8}{9}$	73	40	$0\frac{5}{9}$
14	7	$0\frac{7}{9}$	44	24	$0\frac{4}{9}$	74	41	$0\frac{1}{9}$
15	8	$0\frac{3}{9}$	45	25	0	75	41	$0\frac{6}{9}$
16	8	$0\frac{8}{9}$	46	25	$0\frac{5}{9}$	76	42	$0\frac{2}{9}$
17	9	$0\frac{4}{9}$	47	26	$0\frac{1}{9}$	77	42	$0\frac{7}{9}$
18	10	0	48	26	$0\frac{6}{9}$	78	43	$0\frac{3}{9}$
19	10	$0\frac{5}{9}$	49	27	$0\frac{2}{9}$	79	43	$0\frac{8}{9}$
20	11	$0\frac{1}{9}$	50	27	$0\frac{7}{9}$	80	44	$0\frac{4}{9}$
21	11	$0\frac{6}{9}$	51	28	$0\frac{3}{9}$	81	45	0
22	12	$0\frac{2}{9}$	52	28	$0\frac{8}{9}$	82	45	$0\frac{5}{9}$
23	12	$0\frac{7}{9}$	53	29	$0\frac{4}{9}$	83	46	$0\frac{1}{9}$
24	13	$0\frac{3}{9}$	54	30	0	84	46	$0\frac{6}{9}$
25	13	$0\frac{8}{9}$	55	30	$0\frac{5}{9}$	85	47	$0\frac{2}{9}$
26	14	$0\frac{4}{9}$	56	31	$0\frac{1}{9}$	86	47	$0\frac{7}{9}$
27	15	0	57	31	$0\frac{6}{9}$	87	48	$0\frac{3}{9}$
28	15	$0\frac{5}{9}$	58	32	$0\frac{2}{9}$	88	48	$0\frac{8}{9}$
29	16	$0\frac{1}{9}$	59	32	$0\frac{7}{9}$	89	49	$0\frac{4}{9}$
30	16	$0\frac{6}{9}$	60	33	$0\frac{3}{9}$	90	50	0

What ought to be the Profil or Thickneſs for ſuſtaining the Earths of a Terras, Rampart, &c. *to any given Height poſſible.*

Inſtructions, which are ſaid to have been delivered by the Mareſhal Vauban, *for the Uſe of the Engineers, who ſerved in his Time and under his Directions.*

1. In Countries where the Stone is very good, the Thickneſs at Top may be $4\frac{1}{2}$ Foot; but in Places where it is but indifferent, it may be allowed $5\frac{1}{2}$ Foot, or more, if it be very bad indeed.

2. The Buttreſſes at the Saliant Angles muſt be redoubled and ſloped on each Side, in Proportion to the Right Lines, which form the ſaid Angles.

3. The Key ſhall always be raiſed perpendicularly at the Extremity and the Sides, and well bound to the Body of the Wall.

4. The Buttreſſes ſhall be carried up as high as the Cordon. It would not be amiſs if they were carried up two Foot higher for the Support of the Parapet.

5. In Works where the Facing is carried up but Half-way, or $\frac{3}{4}$ of the Height of the Rampart, and the reſt with Gazon, you muſt allow it the ſame Thickneſs, as if it had been carried up with Stone to the Top of the Rampart: For Example; If it was carried up with Gazon or Sods to the Height of 15 Foot above the Stone-Work, the Top of it ſhould be augmented with 3 Foot; which, with the 5 it had before, will give 8 Foot for the Foot of the Gazon.

6. The Subſtance or Strength of the Buttreſſes, in Proportion to the Height of the Facing: For Example; If the Facing be 35 Foot in Height, (*viz.*) 20 Foot in Stone, and 15 Foot in Gazon, the Buttreſſes muſt be regulated by the Profil of 35 Foot in Height, and the Facing of Stone, muſt be of the ſame Thickneſs at the Height of 20 Foot, as if it had been 35 in Height.

7. That in Places where there are Cavaliers to be made, as at *Maubeuge*, you muſt augment the Thickneſs of the Profil at Top with $\frac{1}{2}$ Foot for every 5 Foot that the Cavalier is to be carried up above the Lining or Wall, and the Buttreſſes ſhall be in Proportion. This is to be underſtood of the great Lining of the Place, and not of thoſe which are ſometimes made for Cavaliers, and only when the Foot of the Cavalier is within 3 or 4 Fathoms of the Parapet.

8. The two laſt Columns of the following Table gives, in Cubic Fathoms, Feet, and Inches, what each running Fathom contains, the Buttreſſes being included.

9. Theſe Profils are only propoſed for the Stone-Work, which is to ſuſtain great Weights of Earth, which has been newly removed, and not for that which is ramm'd upon firm Earth, which has never been removed, as are for the moſt Part the Linings of Moats or Foſſes.

A TABLE *of the Dimenſions of the ſeveral Parts of the General Profil, with the ſolid Content of the Running Fathom, accommodated to the different Height of Walls, from* 10 *to* 80 *Foot.*

Height of the Profil.	Thickneſs of the Profil at Top.	Thickneſs of the Profil at the Retreat.	Diſtance from the Centre of one Buttreſs to that of another.	Diſtance between the Buttreſſes.	Length or Projection of the Buttreſſes.	Thickneſs of Buttreſſes at the Foundation.	Thickneſs of Buttreſſes upon the Retreat.		Solid Content of the Running Fathom of Maſon-Work, including the Buttreſſes at 18 Foot Diſtance from each other.				Solid Content of the Running Fathom of Maſon-Work, including the Buttreſſes at 15 Foot Diſtance from each other.			
Foot.	Foot.	Foot.	Foot.	Foot.	Foot.	Foot.	F.	In.	Fath.	F.	In.	Lines.	Fath.	F.	In.	Lines.
10	5	7	18	15	4	3	2	0	2	0	11	1	2	1	1	4
20	5	9	18	15	6	4	2	8	4	5	0	5	4	5	9	4
30	5	11	18	15	8	5	3	4	8	3	3	1	8	5	1	4
40	5	13	18	15	10	6	4	0	13	2	6	2	14	0	2	8
50	5	15	18	15	12	7	4	8	19	3	8	10	20	4	2	8
60	5	17	18	15	14	8	5	4	27	1	10	2	29	0	2	8
70	5	19	18	15	16	9	6	0	36	3	9	4	39	3	4	0
80	5	21	18	15	18	10	6	8	47	4	5	4	51	2	8	0

The Opinion of Mr. Bullet.

As for the Earths of Ramparts, which puſh inceſſantly, no one ever yet (ſays he) hath laid down any Rule, to aſcertain the Dimenſions or Subſtance of Walls proper to ſupport them. That Earths, the more ſandy they are, the more they puſh, and run, becauſe they are rounder than the Particles of common Earth.

It is demonſtrated (ſays he) from the Principles of Statics, that, in order to ſtop a Ball upon an inclined Plane, it muſt be counter-balanced by a Force or Height, which bears ſuch Proportion to the Weight of the Ball, as the Height of the inclined Plane is to its Length, or as the Side of a Square does to its Diagonal; which Proportion, tho' it be incommenſurable, we may come very near to it: It is as 5 is to 7, wherefore the Reſiſtance of the Wall for ſupporting the Earth of a Triangle, muſt be to the ſaid Triangle as 5 is to 7.

In order to come at the Solution of this, you muſt meaſure the Superficies of the Triangle; to which Purpoſe he ſuppoſes each of its Sides to be 6 Fathoms, from whence the Area of the Triangle will be found to be 18 Fathoms; you are then to find out a Number which is to 18 as 7 is to 5, which will be a little leſs than 13, the Profil then of a Wall for ſuſtaining the ſaid Earth, muſt be 13 Fathoms in Surface. Thus the Reſiſtance of this Wall would be equal to the Puſh of the Earths, if the Stone-Work was to be of the very ſame Specific Gravity with the Earth's.

This being premiſed, the next Thing to be conſidered is, What Talus is to be allowed to the Wall: If it be the Wall of a Rampart, it is commonly allowed a Talus of $\frac{1}{6}$ of its Height; as (for Example)

Example) if the Wall A B (Plate II. Fig. 33.) is 6 Fathoms in Height, it is allowed a Talus of $\frac{1}{6}$, from A to C, which goes ſloping away 2 Inches in a Foot, this Inclination (*viz.*) C B, together with the perpendicular Line A B, forms an Angle of 9°, 27′, 45 Seconds.

And in order to know by this Rule the lower Thickneſs of a Wall which is 6 Fathoms in Height, you muſt reduce the Triangle before mentioned, whoſe Area or Surface is 18 Fathoms, into ſquare Feet, which you will have by multiply 18 by 36, the Product of which Multiplication will be 648, the Number of the ſquare Feet contained within the Triangle aforeſaid, then find a Number that is to 648 as 13 is to 18, which you will have thus by the Rule of Three; as 18 is to 13 ſo is 648 to a fourth Number. This being work'd after the uſual Way, you will have 468 for the Superficies of the Profil of the Wall; which Number (*viz.*) 468, if it be divided by 36, the Height (in Feet) of the ſaid Wall, you will have 13 Foot for its Thickneſs. If it had been uniform throughout, or perpendicular on each Side, but as it has 6 Foot Talus, one Half of them muſt be added to 13, which will make 16 for the lower Thickneſs; and one Half ſubtracted from 13, which will give the upper Thickneſs (*viz.*) 10: So that the whole Height of the Wall (*viz.*) 36 Foot, will be to its lower Thickneſs, as 36 is to 16; and to its upper Thickneſs, as 36 is to 10; and the Profil of the Wall will be to the Triangle of Earth, as 13 is to 18, as was at firſt laid down.

Since this Rule may ſerve to diſcover the due Subſtance or Thickneſs of the Walls or Linings of Ramparts, in Proportion to the Height of Earth they are to ſupport, this Propoſition may be reduced to lower Terms, by taking one Half of 36, which is 18, the one Half of 16, which is 8, for the Thickneſs of the Wall at Bottom; and if the abovesaid Talus be obſerved, you muſt allow 5, the Half of 10, for the upper Thickneſs; for 18, 8, and 5, are, between themſelves, as 36, 16, and 10, which are the Proportions or Dimenſions ſpecified above. Thus may we, by this Rule or Propoſition, have the Thickneſſes of all the Walls or Linings of Ramparts, in Proportion to their Height.

Whatever Variation or Defect can ariſe in this Hypotheſis, muſt be owing to the different Taluſſes which may be given to the Walls or Linings of Ramparts or Terraſſes. I have given $\frac{1}{6}$ of the Height for the Talus of the Linings of Ramparts, thinking that $\frac{1}{5}$ would rather be too much: But this muſt be left to the Deciſion of the prudent Engineer.

As for the Walls of Terraſſes, when they are of no great Height, as (for Example) of 12 Foot, they may be allowed a Talus of $\frac{1}{9}$; and when they are but 6 Foot in Height, $1\frac{1}{2}$ will be enough, if the Work be good.

BRIDGE [of *Boats*] Boats made of Copper, and joined, Side by Side, till they reach acroſs a River, which being covered with Planks, are marched over by the Soldiery.

BRIDGE [of *Ruſhes*] a Bridge made of great Bundles of Ruſhes bound faſt together, over which Planks being laid, and faſtened, are laid over marſhy Places, to be paſſed over either by Foot or Horſe.

A Draw-BRIDGE, one that is faſtened with ſtrong Hinges at one End only, ſo that the other may be drawn up, and then the Bridge ſtands upright, to obſtruct the Paſſage of either Ditch or Moat.

BRIDGE [in *Gunnery*] the two Pieces of Timber which go between the two Tranſums of a Gun-Carriage, on which the Bed reſts.

BRIDGES [in *Heraldry*] probably intimate, that the Bearers have formerly obtained them for their Arms; either for having built Bridges for the Service of the Publick, or elſe by way of Alluſion to the Name, as of *Trowbridge*.

Floating BRIDGE, a Bridge made in Form of a Work in Fortification, called, A Redoubt, conſiſting of two Boats covered with Planks, which are ſolidly framed, ſo as to bear either Horſe or Cannon.

BRIDGE *of Communication*, is a Bridge made over a River, by which two Armies or Forts, which are ſeparated by that River, have a free Communication one with another.

BRIDGE *Flying*, a Term in Fortification: See *Pont Volant*.

BRIEF (or *Breve*) a Term in Law, ſignifying Proceſs that iſſues out of the Chancery, or other Courts, commanding the Sheriff to ſummon or attach *A*, to anſwer to the Suit of *B*, *&c.* But more largely, it is taken from any Precept of the King in Writing under Seal, iſſuing out of any Court, whereby he commands any thing to be done for the Furtherance of Juſtice and good Order.

BRIEF [in *Muſick*] a Meaſure of Quantity, which contains two Strokes down in beating Time, and as many up, and is thus mark'd (1).

BRIGADE, is a Party or Diviſion of a Body of Soldiers, whether Horſe or Foot. There are two Sorts of *Brigades*, according to the *French* Way of accounting. (1.) A *Brigade* of an Army, which is a Body of Horſe conſiſting of 10 or 12 Squadrons, or a Body of Foot of 5 or 6 Batallions: And this way an Army is ſometimes divided into 8 Brigades, 4 of Horſe, and 4 of Foot. (2.) A *Brigade* of a Company of Cavalry is its third Part, when it conſiſts only of 50 Officers; but its ſixth Part when of 100. *Grand Dictionaire Francoiſe.* F.

BRIGADE *Major*, is an Officer appointed by the Brigadeer, to aſſiſt him in the Management and Ordering of his Brigade, and he there acts as a Major-General does in an Army.

BRIGADIER, is he that commands any *Brigade*.

BRIGANTINE, is a ſmall light Veſſel which can both row and ſail well, and is either for fighting or giving Chaſe: It hath about 12 or 15 Benches for the Rowers, one Man to a Bench: All the Hands aboard are Soldiers, and each one hath his Musket lying ready under his Oar. *Great Fr. Dict. of Arts and Sciences.* F.

BRINGERS *up*, in a Batallion, are the whole laſt Rank of Men in it, or the laſt Man in every File.

To BRING *up* [with *Carpenters*] a Term us'd when they diſcourſe with Bricklayers, and then they ſay, *bring* up the Foundation ſo high, *bring up* ſuch a Wall, *bring up* the Chimnies, *&c.* which is as much as to ſay, build the Foundation, *&c.* ſo high.

BRISURE, a Term by ſome Writers of Fortification, for a Line extended in Length from 4 to 5 Fathom, which is allowed to the *Curtain* and *Orillon*, to make a hollow Tower, or to cover the concealed *Flank*. F.

BRISURE [in *Blazonry*] is in *French* derived from *Briſer*, to break, becauſe they ſeem to break the principal Figure, and what the *Engliſh* expreſs by Differences, and is uſed to diſtinguiſh between the elder and younger Brothers, and Baſtards, in a Coat of Arms, as a *Label*, *Half-Moon*, *&c.*

To give a BROAD-*Side* [Sea *Language*] is to diſcharge all the Great Guns which are on one Side of the Ship, at once.

BRODE *Halpeny*, or *Broad Half-peny*, or *Board-hal-penny* (a Term in Law) ſignifying, to be quit of certain Cuſtoms exacted for ſetting up Tables or Boards in Fairs or Markets; and thoſe that were freed by the King's Charter of this Cuſtom, had this Word put in their Letters Patents; by reaſon whereof, at this Day, the Freedom itſelf, for Brevity of Speech, is called *Broad Hal-peny*.

BROKEN *Radiation* [in *Catoptricks*] is the breaking of the Beams of Light, as ſeen through a Glaſs that is cut into ſeveral Panes or Pieces.

BROKEN *Ray*, or *Ray of Refraction*, in *Dioptricks*, is a Right Line, whereby the *Ray of Incidence* changeth its Rectitude, or is broken in traverſing the ſecond *Medium*, whether it be thicker or thinner.

BRONCHANT [in *Blazonry*] ſignifies, ſurmounting, or appearing, as *Bronchant ſur le tout*: *i. e.* ſtanding out, or ſhewing itſelf over all, as when an Eſcutcheon is *ſeme*, or ſtrew'd all over with *fleurs de lis*, or the like, and over them a Beaſt, or other things, that ſeem to cover ſo many of thoſe things, that the Eſcutcheon is ſuppos'd to be ſtrew'd with all over; but that they are hid by that other Bearing that ſtands before them.

BRONCHIA [Βρογχία, *Gr.*] certain hollow Pipes diſperſed through the Lungs, which are Branches of the Wind-Pipe.

BRONCHIALE [*Anatomy*] a particular Artery of the Lungs.

BRONCHOCELE, [Βρογχοκήλη, of Βρόγχος, the *Aſpera Arteria*, and Κηλὴ a Swelling, *Gr.*] is a Tumour in the Top or the middle Fiſtulous Part of the Wind-Pipe. *Blanchard.*

BRONCHOTOMY [Βρογχοτομία of βρόγχος, and τέμνω, *Gr.* to *cut*] is the Section of the Wind-Pipe in a membraneous Part betwixt two of the Rings. It is uſed to prevent Suffocation in People troubled with a *Squinancy* or *Quinſy*.

BRONCHUS [Βρόγχος, *Gr.*] is the Middle Fiſtulous Part of the Wind-Pipe, whoſe Fore-part is made up of ſo many little Rings; the Upper-part is called *Larynx*, and the Under, *Veſicularis*. It ſerves for the Modulation of the Voice, and in Reſpiration.

The Ramifications of the *Aſpera Arteria*, or Wind-Pipe, all over the Lungs, are called the *Bronchia* of the Lungs.

BRONTOLOGY [Βροντολογία, of Βροντὴ, Thunder, and λέγω, to ſay] a Diſcourſe or Treatiſe of Thunder.

BROOMING, or *Breaming of a Ship*, is burning off the Filth ſhe hath contracted on her Sides, with Straw, Reeds, *&c.* when ſhe is on a Careen, or on the Ground; ſo that this is a kind of *Graving*.

BRUDGBOTE, or *Bridgebote*, a Law Term, ſignifying to be quit of giving Aid to the Repair of Bridges.

BRUMAL [*Brumalis*, *L.*] is that which comes in Winter; as the *Brumal Solſtice*, as ſome call the Winter one.

BRUSK: See *Tenny*.

BUBO, is the Groin, or Place from the Bending of the Thigh to the Privy-Parts; alſo a Tumour in the Groin, proceeding from the Pox or Peſtilence. *Blanchard.*

Peſtilential BUBO, a Plague, Sore, or Botch.

Venereal BUBO, a groſs Impoſthume or Swelling, ariſing in the Groin, occaſioned by the *French* Pox.

BUBONOCELE [Βουβωνοκήλη of Βουβὼν, the Groin, and Κηλὴ, a Swelling or Rupture, *Gr.*] is a Rupture, when the Inteſtines fall into the Groin, or the outmoſt Skin of the *Scrotum*: Sometimes it is taken for a Bubo or Swelling. *Blanchard.*

BUCCELLATION, by ſome Chymiſts, ſignifies a dividing into Gobbets.

BUCCINATOR, is the round circular Muſcle of the Cheeks, thin and membranous, interwoven with various Fibres, and inſeparably girt about with the Tunick of the Mouth. *Caſſerius* has obſerved a certain ſtrong Band that grows outwardly in the Centre of this Muſcle, which ſpreading itſelf about the Cheek-Bone, is terminated in a little ſlender Muſcle directly oppoſite to that Part of the Face called *Bucca*: It ariſes from the Upper Jaw-Bone, and is faſtened in the Lower, at the Roots of the Gums. Its Uſe is, to move the Cheeks with the Lips, and ſerves as a Hand to the Teeth, whilſt it toſſes the Meat to and fro, and throws it upon the Teeth, that it may be more exactly chewed. This Muſcle hath the Name of *Buccinator* from its forcing out the Breath of Trumpeters. Mr. *Cowper* ſaith, It ſprings not from the Ends of the Upper, nor ends in that of the Under Jaw, nor is it of that Figure which vulgar Anatomiſts pretend, nor intermix'd with various Orders of Fibres; but that it ariſes broad and fleſhy from the Fore-part of the *Proceſſus Coronæ* of the Lower Jaw, and from hence proceeding with direct Fibres, it adheres to the Gums of both the Jaws, and is ſo inſerted to the Angle of the Lips. Beſides it's Uſe in blowing the Trumpet, Horn, *&c.* it pulls the Mouth to one Side. *L.*

BUCOLICKS [Βουκολικὰ of Βουκόλος, *Gr.* a Cow or Neat-Herd] are Paſtoral Songs or Poems, ſuch as the *Eclogues* of *Virgil*, and the *Idyls* of *Theocritus*, in which Herdſmen and Country Swains, *&c.* are repreſented diſcourſing concerning their Amours, or Love Intrigues.

To BUDDLE, is the Word in the Works for dreſſing *Tin Ore*, for a Tye of Boards or Slate about 4 Foot deep, 6 long, and three over, wherein ſtands a Man with a Shovel in his Hand (called a *Trambling Shovel*, as this is alſo called the *Trambling Buddle*) bare-footed, to caſt up the Ore about an Inch thick, on a long ſquare Board placed juſt before him, and as high as his Middle, which is called the *Buddle Board*: There are ſeveral of theſe *Buddles* in which the Ore is ſtill trambled over again and again, till it be at laſt ſo well waſh'd, as to become what they call *Black Tin*, which is completely ready for the *Blowing Houſe*.

BUDGE *Barrels*, are ſmall Barrels filled with Gun-powder, having a Purſe or Caſe of Leather made faſt over their Head, to prevent the Powder's taking Fire: They are uſed to carry the Powder in on board a Ship.

BUILDING. There are ſome good Rules and Directions about Building, which are given in *Moxon's Mechanick Exerciſes*, and other Books of that kind, which 'tis very proper every Gentleman ſhould be acquainted with, that he may not be cheated or impoſed upon by his Workmen: And thoſe are ſuch as theſe: Firſt, with reſpect to the Foundation, Care ought to be taken, that after the Cellars are dug, if there be any, or if none, after the Trenches are dug, in which the Walls are to ſtand, to try all the Foundations, either by a Crow, a Rammer, or, which is beſt, with a *Borer*, ſuch as

Well-diggers, Miners, *&c.* uſe, whether they are throughly ſound, and are fit to bear the Weight that is to be laid upon them. If the Foundation be not very looſe, it may be cured by ramming in great Stones with an heavy Rammer, the Stones being placed cloſe together, about a Foot wider on each Side of the Trench than the Breadth of the Wall is to be; but if it be ſo looſe that this will not do, you muſt get good Pieces of Oak, whoſe Length muſt be the Breadth of the Trench, or about 2 Foot longer than the Breadth of the Wall, and theſe ſhould be laid acroſs the Foundation, about a Foot aſunder, and being well ramm'd down, lay long Planks upon them, which muſt be pinn'd down to them: And if this be not ſufficient, Piles of a much greater Length muſt be driven down ſo deep, till they touch good Ground, and then ſtrong Planks pinn'd down to their Tops, *&c.* If the Foundation be faulty only in Patches, there may Arches be turned over the inſufficient Places, which will take off the Weight from bearing upon them. And ſometimes it may be proper to uſe *inverted Arches.*

The Foundation being well ſecured, the next Care is, to ſee that the Walls be all made of the ſame Thickneſs as they are in the Deſign; for which Purpoſe there ſhould be Numbers to expreſs their Thickneſs in the Draught.

The Walls alſo muſt be well wrought and *bounded* as they call it; in order to which the Mortar muſt be well made of good well burnt Lime and ſharp Sand; the uſual Proportion is a Load of Sand of 36 Buſhels, to 1 Hundred of Lime of 25 Buſhels, or a Buſhel of Lime to one and a Half of Sand; but when the Sand is not very ſharp, there muſt be a greater Proportion of it to the Lime.

In ſlacking of Lime, Care ſhould be taken, that tho' it be wetted every where a little, yet it be not over-wetted; and every Layer, or Bed of Lime, ſhould be covered with Sand to keep in the Steam, that it may not fly away, but be forced to mix itſelf with the Sand, and this will make the Mortar much ſtronger. The Mortar alſo muſt be well *beaten* with a Beater, three or four times over, before it is uſed, that the Knots of the Lime may be all broken, and the Lime and Sand mingled very well together: And it will be ſtill better, if, after the firſt beating, it be let lie three or four Days, and then let it be beat well over again when 'tis uſed.

If the Bricks are laid in very hot dry Weather, and it be ſome ſmall Piece of Work, which you would have very ſtrong, it will be worth while to dip every Brick, as 'tis laid, in a Pan of Water; and it will be of good Uſe, in great Work, to throw Water on the Walls after the Bricks are laid, by a *Wirtenburgh* Syphon, or ſome ſuch Way. And the Walls alſo ſhould be cover'd in Summer-time, to keep them from drying too haſtily, as well as in Winter-time from Rain, Snow, or Froſt, which laſt is a great Enemy to all Kinds of Mortar, eſpecially to that which hath been newly wetted.

Let the Workmen alſo, in working up the Walls, not carry any one above three Foot high, before the next adjoining Wall is brought up equal with it, that ſo they may join together, and make *good Bond* in the Work.

In the Middle of Walls, Care ſhould be taken that Joint is not laid on Joint, at leaſt as ſeldom as may be, that *good Bond* may be made there as well as on the Out-ſides.

When Timber is laid on Brick-Work, as Torſels for Mantle-Trees, or Lintels for Windows, Templets for Girders, *&c.* let it be always laid in *Loam*, for that is a great Preſerver of Timber, which Mortar will eat and corrode: The ſame thing ſhould be done with the Ends of Joiſts and Girders, ſome Workmen dawb their End with Pitch, to preſerve them from the Mortar.

There ſeems in *Architecture* to be two oppoſite Affectations, *viz.* Uniformity and Variety; yet theſe ſeeming Oppoſites may be very well reconcil'd, as we may obſerve in our own Bodies, the great Pattern of Nature, which is very uniform in the whole Figuration, each Side agreeing with the other in Number, Quality, and Meaſure of the Parts, and yet ſome are round, as the Arms, others flat, as the Hands, ſome prominent, and others indented, or retir'd: So the Limbs of a noble Fabrick may be correſpondent enough, tho' they be various, provided we do not run out into extravagant Fancies, when we are contriving how to part and caſt the whole Work.

Enormous Heights ought to be avoided, of 6 or 7 Stories, as well as irregular Forms; alſo low and diſtended Fronts are unſeemly: And ſo it likewiſe is when the Front of a Building is narrow, and the Face deep.

When we compare the modern *Engliſh* Way of Building with the Ancient, one cannot but admire at the Genius of thoſe times. Nothing is,nor can be more delightful and convenient than Height, and nothing more agreeable to Health than Free Air: And yet of old, their Houſes had moſt of them blind Stair-Caſes, low Cielings, and dark Windows; the Rooms built at random (without any thing of Contrivance) and often with Steps from one to another. Whereas the Genius of our times, is altogether for light Stair-Caſes, fine Saſh-Windows, and lofty Cielings. And thus it has been of late by the Induſtry of our Builders in Point of *Compactneſs* and *Uniformity*, that a Houſe built after the new Way, will afford as many more Conveniencies upon the ſame Quantity of Ground.

The Contrivance of Cloſets in moſt Rooms, and *painted Wainſcot*, are two great Improvements, the one for Conveniency, and the other for Cleanlineſs and Health.

And indeed, for ſo damp a Country as *England* is, nothing could be better contriv'd than Wainſcot, to keep off the ill Impreſſion of damp Walls In ſhort, for handſome Accommodations, and Neatneſs of Lodgings, *London* has, without Doubt, got the Preheminence.

The *Plaiſtered Cielings* ſo much uſed in *England* beyond other Countries, do, by their Whiteneſs, make the Rooms much lightſomer, and are very good againſt Fires. They likewiſe ſtop the Paſſage of the Duſt, and leſſen the Noiſe over-head; and in Summer-time, the Air of a Room is ſomething the cooler for them, and in the Winter, ſomething the warmer; becauſe it keeps out cold Air then better than boarded Floors alone can do.

Vitruvius, *lib.* 1. *cap.* 1. briefly determines ſix Conſiderations, which comprehend the whole Art of Building, *viz.* *Ordination*, *Diſpoſition*, *Eurithmy*, *Symmetry*, *Decor* or *Beauty*, and *Diſtribution.*

The two firſt of theſe may very well be ſpared, or omitted. By the firſt, or *Ordination*, he means a well ſettling the Model or Scheme of the whole Work. By *Diſpoſition*, a neat and full Expreſſion of the firſt Idea or Deſign thereof.

3. *Eurythmy* is that agreeable Harmony between the Breadth, Length, and Height, of all the Rooms of the Fabrick; which is very pleaſing to all Beholders; which is always ſo to all, by a ſecret Power which is in Proportion.

4. *Symmetry* is a due Proportion of each Part in reſpect to the whole, whereby a great Fabrick ſhould have great Apartments or Rooms, great Lights or Windows, great Entrances or Doors, great Stair-Caſes, great Pillars, Pilaſters, *&c.* in fine, all the Members and Parts proportionable to the Building.

For, as it would be but an odd Sight, to ſee a great Man with ſmall Leggs, Feet, Arms, Hands, *&c.* ſo alſo it would be uncomely to ſee a large Fabrick conſiſting of little *Apartments*, *Lights*, *Stair-Caſes*, *Entrances*, *&c.* So on the other hand, to ſee a little Man poſſeſt of large Members and Limbs: It is alſo as unſightly, to ſee a ſmall Fabrick to be contriv'd into great Rooms, to have large Stair-Caſes, Entrances, Lights, *&c.*

Again: As it is an unſeemly Sight, to ſee either a great or little Man to have ſome of his Members proportionable to his Body, and others ſo large, as if they belonged to a Monſter or Giant, and not to him: So it will be equally as ugly, to ſee a little Houſe or Edifice, to have ſome of its Parts monſtrous, *viz.* great in ſome Parts of the *Apartments*, and by conſequence others muſt be as little, or ſome muſt be annihilated; and ſo by conſequence will be wanting: Or great *Stair-Caſes*, great *Windows*, great *Doors*, or any other Members larger than they ought to be, in reſpect to the *Symmetry* of the Parts.

It is likewiſe unhandſome to ſee ſome of the Parts too little, (that they are not proportionable to the whole Structure) as to ſee a Man have one very ſmall Leg, and the other proportionable to his Body.

5. *Decor.* This is a keeping a due Reſpect between the *Inhabitant* and the *Habitation*, whence *Palladio* concluded, that the principal Entrance was not to be regulated by any certain Dimenſions, but by the Dignity of the Owner or Poſſeſſor; yet to exceed rather in the more than in the leſs, is a Mark of Generoſity, and may always be excus'd by ſome noble Emblem or Inſcription, as that of the *Conte de Bevilacqua* over his Gate at *Verona*, where it is likely there had been committed a little Diſproportion, thus:

Patet Janua, cor magis.

6. *Diſtribution* is that uſeful caſting or contriveing of all Rooms for *Office*, *Entertainment*, or *Pleaſure.*

Regular BUILDING, its Plan is ſquare, its oppoſite Sides equal, and its Parts diſpos'd with Symmetry.

Irregular BUILDING, that which is not contained within equal and parallel Lines, and whoſe Parts have not a juſt Relation one to the other in the Elevation.

Inſulated BUILDING, one which is not attach'd, join'd, or contiguous to any other; or is encompaſſed with a Square, as the *Monument*, *S. Paul's*, &c.

Engaged BUILDING, one compaſs'd, and haveing no Front towards any Street or publick Place, nor Communication, but by a narrow Paſſage.

Interred BUILDING, *Sunk* BUILDING, is ſuch, the *Area* of which is below the Level or Surface of the Place on which it ſtands, and of which the loweſt Courſes of Stone are hidden.

BULBOUS *Roots*, are ſuch as are deſcribed in the Word *Bulbus.*

BULBUS, [in *Botany*] ſignifies the round Root of a Plant encompaſſed about with many Coats, (like an Onion) one within another; or elſe ſet round thick with many ſmall Scales; and which ſends out many Strings or Fibres from the Bottom of the *Bulb*, or Baſe of the Root. *L.*

BULGED, BILGED, [*Sea-Term*] uſed of a Ship, when ſhe has ſtruck off ſome of her Timber againſt a Rock or Anchor.

BULIMIA, [Βȣλιμία of Βȣ͂ς an *Ox*, and *λιμὸς*, *Gr.* Hunger] an Ox-like Appetite, that is, when the Hunger is ſomewhat greater than that which is called *Fames Canina*, or when the Stomach craves, but cannot receive; whereas in the other Caſe, the Eating is anſwerable to the Appetite. *Blanchard.*

BULK *of a Ship*, is her whole Content in the Hold for the Stowage of Goods.

BULK-HEADS, are Partitions made acroſs a Ship with Boards of Timber, whereby one Part is divided from another. The *Bulk-head* afore is the Partition between the Fore-caſtle and Grating in the Head, and in which are the *Chaſe Ports.*

BULLET, an Iron or leaden Ball, or Shot, wherewith Fire-Arms are loaded. Bullets are of various Kinds, *viz.* *Red Bullets*, made hot in a Forge, intended to ſet Fire to Places where combuſtible Matters are found. *Hollow Bullets*, or Shells made cylindrical, with an Aperture and a Fuſee at one End, which giving Fire to the Inſide, when in the Ground it burſts, and has the ſame Effect with a Mine. *Chain Bullets*, which conſiſt of two Balls join'd by a Chain three or four Foot apart. *Branch Bullets*, two Balls join'd by a Bar of Iron five or ſix Inches apart. *Two-headed Bullets*, called alſo *Angles*, two Halfs of a Bullet join'd by a Bar or Chain: Theſe are chiefly uſed at Sea, for cutting of Cords, Cables, Sails, *&c.* Some derive the Word from the Latin *Botellus*, others from the *Greek* Βάλλειν, to throw.

According to *Merſenne*, a *Bullet* ſhot out of a great Gun, flies 92 Fathoms in a Second of Time, which is equal to $589\frac{1}{2}$ *Engliſh* Feet: And according to *Huygens*, would be 25 Years in paſſing from the Earth to the Sun. But according to ſome very accurate Experiments of Mr. *Derham*, it flieth 510 Yards in five Half Seconds; which is a Mile in a little more than 17 Half Seconds. Allowing therefore the Sun's Diſtance 86,051,398 *Engliſh* Miles, a Bullet will be $32\frac{1}{2}$ Years in its Paſſage. See *Sound.*

BULLION, is taken for Gold or Silver in the Maſs or Billet; it is alſo us'd for the Place where Gold or Silver is brought to be tried and exchanged.

BULRUSH-BRIDGE, in Fortification, is a *Bridge* made of many Bundles of Bull-ruſhes, bound together and cover'd with Planks, to ſecure a Paſſage over the Bogs, Marſhes, and Fenny Places.

BULWARK, much the ſame (anciently) with a *Baſtion* in Fortification: Which ſee.

BUNT *of a Sail*, is the middle Part of it, which is purpoſely formed into a kind of Bag or Cavity, that the Sail may receive the more Wind: It is chiefly uſed in Top-ſails; for Courſes are for the moſt Part cut ſquare, or at leaſt with a ſmall Allowance for *Bunt* or Compaſs. They ſay the *Bunt holds much Lee-ward Wind*, *i. e.* the *Bunt* hangs too much to the Lee-ward.

BUNT-LINES, are ſmall Lines made faſt to the Bottom of the Sails, in the middle Part of the *Bolt-Rope*, to the Crengle, and ſo are reav'd thro' a ſmall Block ſeized to the Yard: Their Uſe is to trice up the Bunt of the Sail, for the better furling of it up.

BUOY. A *Buoy* at Sea is a Piece of Wood, or a Barrel, faſten'd ſo as to float directly over the

Anchor, that ſo the Men that go in the Boat to weigh the Anchor may certainly know where it lies. The Term of Art is, *Stream the Buoy*, that is, let the Anchor fall while the Ship has Way. From hence the Word *Buoyant* ſignifies any thing that is floating or floatable.

To buoy up a Cable, is, to faſten ſome Piece of Wood, or Barrel, *&c.* to the Cable near the Anchor, that the Cable may not touch the Ground when they ſuſpect the Ground to be foul (that is, Rocky) leſt the Cable ſhould be fretted and cut off.

BUOYS are alſo uſed at Sea, to diſcover Rocks and Shelves, by being faſten'd over them.

BURBREACH (a Term in Law) is to be quit of Treſpaſſes committed againſt the Peace in City or Borough.

BURELLE [in *Blazonry*] is a *French* Term, which, as *Columbier* ſays, ſhould be called, Barry of 19 Pieces: But if there be more than 10, the Number is to be expreſs'd, and the Pieces in *Burelle* muſt be even Numbers; for if the Number be odd, and the Field have more Parts than are in the Charge, then the Pieces that are charged in the Field muſt be called by the Name of *Trangles*.

BURGAGE, is a Tenure proper to Cities, Boroughs, and Towns, whereby the Burghers, Citizens, or Townſmen, hold their Lands or Tenements of the King, or other Lords, for a certain Rent.

BURGANET, BURGONET, [*Heraldry*] Probably ſo called of the *Burgundians* who wore it, a ſort of Steel Cap, anciently worn by Foot-Soldiers in Battle.

BURGHBOTE, is a Contribution towards the Building or Repairing of ſome Caſtles or Walls of Defence, or towards the Building of a Borough or City: From which Duty ſeveral Perſons had obtained an Exemption, by the Ancient Charters of our *Saxon* Kings, whence the Word is often taken for the Liberty or Exemption from ſuch Cuſtomary Service.

BURGLARY, naturally ſignifies the Robbing of a Houſe; but in a Legal Senſe, is a Felonious entring into another Man's Dwelling, wherein ſome Perſon is; or into a Church in the Night-time, to the End to commit ſome Felony, or to kill ſome Man, or to ſteal ſomewhat thence, or do ſome other Felonious Act, albeit he executes not the ſame.

BURGMOTE, is a Court of a Borough or City.

BURNING-GLASS. One M. *Villette* made a Metalline Burning Concave at *Lyons* in *France*, of a round Figure 30 Inches Diameter, and of about 100 ℔ Weight. The *Focus*, or burning Point, being diſtant from the Concave about 3 Foot; and its Bigneſs, that of one Half of a *Louis D'Or*: It would melt Iron in 40 Seconds, Silver in 24, Copper in 42, and turn'd Quarry-Stone into Glaſs in 45, and Mortar in 53 Seconds. It melted a Piece of Watch-Spring, of Steel, in 9 Seconds. *Philoſ. Tranſ. N. 6.*

After that, *Vilette* made another of 34 Inches Diameter, which would melt all ſorts of Metals of the Thickneſs of a Crown Piece, in leſs than a Minute, and vitrifie Brick in the ſame time. *Phil. Tranſ. N.* 49.

Francis Smithwick, Eſq; F. R. S. produced before the Royal Society, *Feb.* 27. 1667-8. two Burning Concave Glaſſes, of a Figure not Spherical; one of 6 Inches Diameter, and its *Focus* 3 Inches diſtant from the Centre; the other of the ſame Diameter, but leſs Concave, and its *Focus* 10 Inches diſtant. Thoſe, when approached to a large Candle lighted, did ſomewhat warm the Faces of ſuch as were 4 or 5 Foot diſtant at leaſt; and when held to the Fire, burned Gloves and Garments at three Foot Diſtance from the Fire: He did alſo, with the deeper of them, in the Preſence of Biſhop *Ward*, turn a Piece of Wood into Flame in 10 Seconds of Time; and with the ſhallower, in 5 Seconds, in *Autumn*, about 9 in the Morning, and the Weather gloomy. *Phil. Tranſ. N.* 33.

In *Philoſ. Tranſact. N.* 40. there is an Account of one *S. Setalla*, at *Milan*, who was cauſing a Burning-Glaſs to be made of 7 Foot in Diameter, and he pretends to make it burn at the Diſtance of 50 Palm, or 33 Foot.

And in *N.* 188. there is Mention of a Burning Concave which was made at *Luſace* in *Germany*, of near 3 *Leipſick* Ells in Diameter, which exceeds the great one at *Paris* by ⅜ of an Ell. This was made of a Copper-Plate, ſcarce twice ſo thick as the Back of a common Knife, and ſo may eaſily be moved from Place to Place, and ordered for Uſe; and the Workmanſhip of it may, by the Contrivances I have invented (ſaith the *German*) be eaſily, and in a little time, perform'd by one Man. The Poliſh hereof is very good, and repreſents, by diſtinct Reflexions, all thoſe Appearances which ariſe from the Concave Figure thereof.

The Force of this Speculum is incredible: For, 1. A piece of Wood put in the *Focus* (which is 2 Ells off) flames in a Moment, ſo as a freſh Wind can hardly put it out. 2. Water applied in an Earthen Veſſel preſently boils. 3. A Piece of Lead or Tin 3 Inches thick, melts away in Drops, and in 2 or 3 Minutes time, will be melted quite thro'. 4. A Plate of Iron or Steel is preſently red hot, and ſoon after hath a Hole burnt thro' it. I have made 3 ſuch Holes in a Plate in 6 Minutes time. 5. Copper and Silver, and the like, applied to the *Focus*, melt; I tried with a Rix-Dollar: And the Iron aforeſaid will run in 5 or 6 Minutes. 6. Slate at firſt is red hot, but in a few Minutes turns into a fine ſort of black Glaſs, of which, if any Part be taken in the Tongs, and drawn out, it runs into Glaſs-Threads. 7. Tiles and Earthen Pot-ſhreads, in a little time melt into Glaſs, as alſo doth Pumice Stone into a very white one: A Piece of a very ſtrong Crucible runs into Glaſs in 8 Minutes. I have ſeen Bones turn into Glaſs of an Opaque Kind, and a Clod of Earth into greeniſh Glaſs. Theſe Experiments were made in *Auguſt* and *September*.

Dr. *Hook* propoſed to the Society, that one might be made after this Manner, of many Feet in Diameter for a ſmall Price, being hammer'd out of a Copper-Plate, and tinn'd over with a Mixture of Tin, Lead, and Tin-glaſs, which is found to bear a very good Poliſh.

The Uſes of ſuch a Speculum will be very many, and perhaps its Effects wonderful, there being no other Heat in the World any thing like that of the Sun's Rays, whoſe Weight and Fineneſs are not poſſible to be equall'd by any common Fire; yet the Moon's Rays, tho' the Light was augmented by the Glaſs, gave no manner of Heat.

Mr. *Tſchirnhaus* is ſaid to have made Convex Burning-Glaſſes of 3 or 4 Foot Diameter, and whoſe *Focus* is 12 Foot diſtant, and of 1½ Inch in Diameter; and to make this *Focus* yet ſtronger, he contracts it by a ſecond *Lens*, placed parallel to, and at a due Diſtance from the firſt, and then the *Focus* is but of 8 Lines in Diameter. This Glaſs in a

Moment vitrifies Tiles, Slates, Pumice Stones, *Dutch* Ware, and *Talk*. It melts Sulphur, Pitch, and all Roſins under Water; any Metal, expoſed to it in little Lumps upon a Coal, melts in a Moment, and Iron ſparkles as in a Smith's Forge. All Metals vitrify on a Piece of *China* Plate, if it be not ſo thin as to melt itſelf; and Gold in vitrifying *receives a Purple Colour: Hiſtoire de l'Academie des Sciences*, *Anne* 1699.

The *Linum Vivum* or *Asbeſtos* would be vitrified by this Glaſs, even in *January*, in about 10 Minutes Time. *Vid. Act. Erud. Leipſ. April.* 1688.

The incomparable Sir *Iſaac Newton* preſented a Burning-Glaſs to the Royal Society of *London*, whereof he was the moſt worthy Preſident, conſiſting of ſeven Concave Glaſſes, and ſo placed, as that all their Foci join in one Phyſical Point: Each Glaſs is about 11 Inches and a Half in Diameter, Six of them are placed round the Seventh, to which they are all contiguous, and they compoſe a kind of Segment of a Sphere, whoſe Subtenſe is about 34½ Inches. The Central Glaſs lies about an Inch lower, or farther in, than the reſt. The common Focus is about 22½ Inches diſtant, and of about Half an Inch in Diameter. It vitrifies Brick or Tile in a Moment, and in about Half a Minute melts Gold.

If another Round of Concaves were added about theſe Seven, perhaps it would out-do any thing we have an Account of.

BURNING-ZONE: See *Zone*.

BURR *Pump* [in a *Ship*] a Pump by the Side of a Ship, into which a Staff 7 or 8 Foot long is put, having a Burr of Wood at the End, which is drawn up by a Rope faſten'd to the Middle of it, called alſo a *Bildge Pump*.

BURRAS *Pipe* [with *Surgeons*, &c.] an Inſtrument or Veſſel uſed for keeping corroding Powders in, as *Vitriol*, *Precipitate*, &c.

BURREL *Shot* [in *Gunnery*] ſmall Bullets, Nails, Stones, Pieces of old Iron, *&c.* put into Caſes, to be diſcharged out of the Ordnance or Murdering-Pieces; a ſort of Caſe-Shot.

BURSALIS [*Anatomy*] a Muſcle of the Inſide of the Thigh, ſo called from its Reſemblance to a Purſe, in *Latin*, *Burſa*.

BURTON, on board a Ship, is a ſmall Tackle to be faſten'd any where at Pleaſure, conſiſting of 2 ſingle Pullies: It uſe is, to hoiſt ſmall Things in or out; and this will purchaſe more than a ſingle Tackle with two Blocks.

BUSHEL, a Meaſure of Capacity for Things dry, as *Grain*, *Pulſe*, *Dry Fruits*, *&c.* The *Engliſh Buſhel* contains 4 Pecks, or 8 Gallons, or ⅛ of a Quarter. See *Meaſure*.

BUST, is a Term in Sculpture, ſignifying a *Figure* or *Statue* of but one Half of a Human Body; the Head, Shoulders, and Breaſts appear, but no Arms, and it is made tapering from the Breaſt downwards.

BUSTROPHEDON, [Βȣϛροφηδὸν of Βȣ̃ς an *Ox*, and ϛρέφω, *Gr.* to *turn*] the turning of Oxen when they plow the Ground. This (as *Marius Victorinus* tells us) was the ancient Manner of Writing among the *Romans*, who at firſt writ as it were in Furrows, the firſt Line beginning at the Left-Hand, went to the Right; and then the ſecond beginning at the Right-Hand, was continu'd back to the Left: and ſo it look'd like the Furrows of Land plowed by Oxen.

BUTMENTS [in *Architecture*] thoſe Supporters or Props, on or againſt which the Feet of Arches reſt: Alſo little Places taken out of the Yard or the Ground-Plot of an Houſe, for a *Buttery*, *Scullery*, *&c.* are ſometimes called *Butments*. The Word comes from the *French*, *Bouter*, to abut or terminate on any thing.

BUTT, or *Pipe of Wine*, a Meaſure containing two Hogſheads, or 126 Gallons.

BUTT, [in the *Sea Language*] is the End of any Plank which joins to another on the Outſide of a Ship under Water; and therefore, when a Plank is looſe at one End, they call it *Springing a Butt*; to prevent which, Ships are uſually bolted at the *Butt Heads*, that is, at the Planks End.

BUTTER *of Antimony*, or as ſome call it, *The Icy Oil* of that Mineral is a great *Cauſtick* made by uniting the acid Spirits of Sublimate Corroſive with Regulus of Antimony, thus:

Six Ounces of Regulus is mixed with a Pound of Sublimate, both powdered, and then the Matter is put into a Glaſs Retort, whoſe Half muſt be empty; diſtil in Sand with a ſmall Fire at firſt, a little clear Oil; then encreaſe the Fire, and a white thick Liquor, like Butter, will come forth; which, if a Pan of Coals be not applied to melt it, will choak up, and it may be, break the Neck of the Receiver: Continue the Fire till the red Vapours come; then unlute the Receiver, and if you have a mind to recover the Mercury, apply another filled with Water in its Room, the Quick-ſilver will run over into the Water. This *Butter of Antimony* is uſed to eat Proud Fleſh, and to cleanſe Ulcers.

BUTTER *of Tin*, is made after the ſame Manner, of one Part of Tin in Powder, and three Parts of Sublimate Corroſive; and what is very ſtrange of this Jovial Butter, it is continually emitting Fumes, or ſmoaking.

BUTTOCK *of a Ship*, is that Part of her which is her Breadth right a-Stern from the Tack upwards. According as a Ship is built broad or narrow at the Tranſom, ſhe is ſaid to have a broad or a narrow *Buttock*.

BUTTRESS, [in *Architecture*] is a Prop or Support, either of Brick or Stone, ſet to keep the Work the firmer in its Poſition, as againſt Brick or Stone Walls, that are high, or have any conſiderable Weight againſt them on the other Side, as a Bank of Earth, or the like: They are alſo uſed againſt the Angles of Steeples, Churches, and other Buildings, of Stone, *&c.* on their Outſide, and along the Walls of ſuch Buildings as have great and heavy Roofs, as would be ſubject to thruſt the Walls out (if they were not thick) if there were no Buttreſſes placed againſt them.

BUTTRESSES are alſo placed for a Support and Butment, againſt the Feet of Arches that are turned acroſs ſome great Halls, in old Palaces, Abbies, *&c.* and generally at the Head of Stone-Buildings, where there are great Crochet Windows. There are, for the moſt Part, great *Buttreſſes* placed for *Butments* to the Arches of theſe Windows.

BY-LANDER. See *Belandre*.

BY-LAWS, are Orders made in Court-Leets or Court-Barons, by common Conſent, for the Good of thoſe that exact them, and which extend farther than the Publick Law binds. *Blunt.*

BYQUARTILE, the ſame with *Biquartile*.

CABALA [קבלה, Receiving, *Heb.*] a traditional or myſterious Doctrine among the ancient Jews, which they ſay, was delivered by Word of Mouth to *Moſes*, and by him to the Fathers, and ſo tranſmitted from Generation to Generation; and at length, about the Time of their Captivity in *Babylon*, collected into a Body, called, *The Miſhnaoth*; which, with the Commentaries and Gloſſes of their Doctors and Rabbies, compoſe the Work called *The Talmud*, being 7 Volumes in Folio.

CABALLINE [of *Caballinus*, *L.*] *Aloes*, is a coarſer Sort, which being generally uſed by Farriers to purge Horſes, is called by this Name of *Caballine Aloes*.

CABINET, [*Architecture*] ſtrictly taken, is the moſt retir'd Place in a Houſe; but a *Cabinet* in Palaces and great Houſes, conſiſts of an Outer-Chamber, an Anti-Chamber, and a Cabinet with a Gallery on the Side.

CABLE *of a Ship*; is (as is well known) a great Rope of 3 Strands, which being faſtened to the Anchor, holdeth the Ship faſt when ſhe rides. The Sea Terms about it are: 1. *The Cable is well laid*; that is, is well wrought, or made. 2. *Serve the Cable*, or *Plat the Cable*; that is, bind it about with Ropes, Clouts, *&c.* to keep it from galling in the Hawſe. 3. *To ſplice a Cable*, is, to make two Pieces faſt together, by working the ſeveral Strands of the Rope one into another. 4. *To quoil the Cable*, is, to roll it up round in a Ring, of which the ſeveral Rolls, one upon another, are called *Cable Tire*. 5. They ſay, *Pay more Cable*; that is, let it more out from the Ship, that the Boat which carries the Anchor, may the more eaſily drop it into the Sea; and ſometimes they ſay, *Pay cheap the Cable* (i. e.) put, or hand it out apace. In the ſame Senſe as *Pay more Cable*, they ſay alſo, *Veer more Cable*; that is, hand or let more out. When two Cables are ſpliced together, 'tis called, *A Shot of a Cable*.

CABLED *Flutes* [in *Architecture*] Flutes that are filled up with Pieces reſembling Cables.

CABOSED, CABOCHED (*Spaniſh*) the Term in Heraldry for the Head of any Beaſts, being cut off juſt behind the Ears, by a Section parallel to the Face, or by a perpendicular Section; whereas *Couping* is uſually expreſſed by an Horizontal one, and is never ſo cloſe to the Ears as *Caboſing*.

CABURNS [in a Ship] are Lines uſed to bind Cables withal: They are uſually made of *Rope Yarn* or *Spun Yarn*.

CACATORIA *Febris*, is an intermittent Fever, (ſo called by the famous *Sylvius*) accompanied with a violent Purging, which is ſometimes griping and very painful, extremely afflicting and weakening to the Patient.

CACHECTICUS, [Καχεκτικὸς, *Gr.*] is one that has an ill Habit of Body.

CACHEXY, [Καχεξία, of Κακὸς and ἕξις, *Gr. Habit*] is an ill Habit of Body, proceeding from a bad Diſpoſition of the Fluids and Humours; whence lingring Fevers, Conſumptions, and Dropſies, are contracted. In this Diſeaſe the Face is often pale and diſcoloured, and the Body big and ſwoln *Cachexia*, taken alſo in a large Senſe, is oppoſite to εὐεξία, and, as a good Habit of Body is common to all ſound Parts, ſo an ill one is propagated by all the ill Parts. Strictly, *Cachexy* is only taken for an ill Diſpoſition of the Habit of the Body; and *Euexia*, on the contrary, for a good Diſpoſition of the Humours, or Blood, and Body. *Blanchard.*

CACOCHYMY, [Κακοχυμία, of Κακὸς, *Bad*, and χυμὸς, *Gr.* Juice,] is the Abundance of ill Humours in the Blood; and it is either Ulcerous, Bilious; Pituitous, Melancholick, Acid, Salt, or Sharp. *Blanchard.*

CACOETHES, [Κακοήθης, of Κακὸς and ἦθος, *Manner* or *Cuſtom*, *Gr.*] *Chironium Ulcus*, or *Telephium*, is a Diſeaſe or Ulcer beyond Cure, which is called *a Malignant Ulcer*; this happens when an Ulcer is callous or ſinuous, under which there ſometimes lie little putrified Bones that have fallen down. *Blanchard.*

CADENCE, or *Cloſe*, in Muſick, is a kind of Concluſion of the Tune, which is made of all the Parts together, in divers Places of any Key.

CADUCUS *Morbus*, or the *Epilepſy*, is a Convulſive Motion of all the Parts of the Body, more eſpecially in the Hands and Feet, accompanied with a Deprivation of the inward and outward Senſes. *L.*

CÆCUM *inteſtinum*, the Blind Gut, ſo called, becauſe one End of it is ſhut up, inſomuch that *Fæces* and *Chyle* both come in and go out at the ſame Orifice. Its Uſe in Man is obſcure, as being very ſmall, and commonly empty. *L.*

CÆSAREAN *Section*, the cutting open of a Woman's Belly, or Womb, to make way for the Child to be taken out; ſo called of *Julius Cæſar*, who was after that manner brought into the World.

CÆSURA, in Grammar, is, when in a *Latin* or *Greek* Verſe there remains a Syllable after a Foot, and that Syllable ends the Word. Of this they reckon four Sorts: *Triemimeris*, *Penthemimeris*, *Hepthemimeris*, and *Ennemimeris*: Which ſee.

If it were not for *Cæſura*, few Verſes could be made to run well; as is plain in theſe two, where there is no *Cæſura* at all,

Aurea Carmina, Juli, ſcribis, maxime vatum.
Urbem fortem cœpit nuper fortiter Hoſtis.

CAISSON, or Superficial *Fourneau*, is a Wooden Caſe or Cheſt, into which 3, 4, 5, or 6 Bombs, according to the Execution they are to do, or as the Ground is firmer or looſer (ſometimes the Cheſt is only filled with Powder) when the beſieged diſpute every Foot of Ground. This *Caiſſon* is buried under ſome Work the Enemy intends to poſſeſs himſelf of, and when he is Maſter of it, they fire it by a Train conveyed in a Pipe, and ſo blow them up. Thus they ſay, after the Mine has deſtroyed the Bonnet: *A* Caiſſon *was buried under the Ground thrown up, and the Enemy advancing to make a Lodgment on the Ruins of the Bonnet, the* Caiſſon *was fired, and blew up the Poſt the ſecond time.*

CAISSON, is alſo a covered Waggon, to carry Bread or Ammunition. *F.*

CALAMUS *Scriptorius*, is a certain Dilatation in or about the fourth Ventricle of the Brain, whoſe lower Part is inſerted into the *Medulla Oblongata*, making there a Cavity in ſhape of a Pen; whence it was anciently called, *Calamus Scriptorius*. *L.*

CALCANEUS, or *Os Calcis*, the *Heel Bone*, is a Bone of the *Tarſus*; it lies under the *Aſtragalus*, to which it is articulated by the *Ginglymus*. Behind it has a large Protuberance which makes the Heel, and into which the *Tendo Achillis* is inſerted; and before, it has a Cavity which receives a Part of the *Os Cubiforme*. L.

CALCHOIDEA, are three little Bones in the Foot, which, with others, make up that Part of the Foot ſucceeding the Ankle; and *Fallopius* calls them *Cuneiformia*, becauſe they are made like Wedges.

CALCINATION, is the Solution of a mix'd Body into Powder, by Fire, or any corroding things, as *Mercury*, *Aqua fortis*, *&c.* and when Horns, Bones, Hoofs, *&c.* are hang'd over boiling Water (or other Liquor) till they have loſt their Mulcilage, and will eaſily be powder'd, this, by ſome Chymiſts, is called *Calcination Philoſophical*. L.

CALCINATION *of Copper*: See *Æs Uſtum*.

CALCINATION *of Flints*, or of *Cryſtal*, *Pebbles*, *&c.* is made by heating them red hot, and then caſting them, whilſt ſo, into cold Water, or Vinegar; for, after this is done 4 or 5 times, they will be very friable, and eaſily powdered, for which End they are calcined.

CALCINATION *of Lead*. Melt the Mettle in an Earthen Pan unglaz'd, keep it ſtirred over the Fire with a *Spatula*, till it be reduced into a Powder. This is what they call *Calx of Lead*, and by this Means the Metal is made more open, and fit to be wrought upon by Acids. *Lead*, as well as *Tin*, ſenſibly encreaſes its Weight in Calcination.

CALCINATION *of Tin*. Put *Engliſh* Tin into a large Earthen Pan, unglazed, into a great Fire, and then the *Tin* will melt; continue the Fire very ſtrong for 36 Hours, ſtirring the Matter with an Iron *Spatula*, from time to time; then take it off the Fire, and let it cool, and you will have the *Calx of Tin*. The *Tin* will increaſe its Weight in this Operation; for 32 Ounces of Metal will yield 34 Ounces of *Calx*.

CALCINATION *of Vitriol*, is uſually of the Green Sort; 'tis put over the Fire in an Earthen unglazed Pan; the *Vitriol* will diſſolve into a kind of Water; then 'tis boiled till the Moiſture be conſumed, or till it turn into a greyiſh Maſs. This is called, *Vitriol calcin'd to Whiteneſs*. Then, if it were kept long over a ſtrong Fire, it would turn *Red*, and is then called *Colcothar*.

CALCIS: See *Calcaneus*.

CALCULATION *of Clock and Watch Work*: See *Clock* and *Watch Work*.

CALCULUS, or *Methodus Differentialis*, [in *Mathematicks*] is a Method of differencing Quantities, or of finding an infinitely ſmall Quantity, which being taken infinite times, ſhall be equal to a given Quantity; or an *Infiniteſimal*, which is a Portion of a Quantity incomparable to that Quantity, or, as others define it, The Arithmetick of infinitely ſmall Differences between variable Quantities. The Foundation then of this *Calculus* is, an infinitely ſmall Quantity, or, that is leſs than any aſſignable one, and therefore is acounted as nothing, the Error accruing by omitting it, being leſs than any aſſignable one, *i. e.* leſs than nothing; hence two Quantities, only differing by an Infiniteſimal, are equal. The better to conceive the Nature of an Infiniteſimal, ſuppoſe, that in meaſuring the Height of a Mountain, while you are looking thro' the Sights, the Winds blows off the ſmalleſt Grain of Duſt, the Height of the Mountain is then leſs, by the Diameter of the Duſt, than before; but as the Mountain is ſtill found the ſame Height, whether the Duſt be there or not, its Diameter has nothing to do in the preſent Caſe, and paſſes for nothing, *i. e.* is infinitely ſmall. Thus, in *Aſtronomy*, the Diameter of the Earth is an Infiniteſimal in reſpect of the Diſtance of the fix'd Stars: And the ſame holds in Aſtronomical Quantities; the Name *Infiniteſimal* therefore is merely reſpective, and involves a Relation to another Quantity, not any real Ens or Being. Now *Infiniteſimals* are called *Differentials*, or *Differential Quantities*, when they are conſidered as the Differences of two Quantities. Sir *Iſaac Newton* calls them *Fluxions*, conſidering them as the momentary Increments of Quantities, *v. g.* of a Line generated by the Flux of a Point, or of a Surface by the Flux of a Line, *&c.* The *Differential Calculus* therefore, and the Doctrine of Fluxions, are the ſame thing under different Names; the former given by M. *Leibnitz*, and the latter by Sir *Iſaac Newton*; each of whom lay Claim to the Diſcovery: See *Fluxions*. There is indeed a Difference in the Manner of expreſſing the Quantities, reſulting from the different Views wherein the two Authors conſider the *Infiniteſimals*; the one, as Increments; the other, as Differences. *Leibnitz*, and moſt Foreigners, expreſs the Differentials of Quantities by the ſame Letter as variable ones, only prefixing the Letter d, thus: The Differential of x is called dx, and that of y, dy. Now dx is a poſitive Quantity, if x continually increaſe; negative, if it decreaſe.

The *Engliſh*, with Sir *Iſaac Newton*, inſtead of dx, write x (with a Dot over it) for dy, y, &c. which Foreigners object againſt, on account of that Confuſion of Points which they imagine ariſes when Differentials are again differenced: Beſides, that the Printers are more apt to overlook a Point than a Letter.

Stable Quantities being always expreſſed by the firſt Letters of the Alphabet, $da = o$, $db = o$, $dc = o$; wherefore $d\ (x + y - a) = dx + dy$, and $d\ (x - y + a)\ dx - dy$, ſo that the differencing of Quantities is eaſily perform'd, by the Addition or Subtraction of their Compounds.

To difference Quantities that mutually multiply each other, the Rule is: Firſt, multiply the Differential of one Factor into the other Factor, the Sum of the two Factors is the Differential ſought; thus, the Quantities being $x\,y$, the Differential will be $xdy + ydx$, i. e. $d\ (x\,y) = xdy + ydx$. Secondly, if there be three Quantities, mutually multiply each other, the Factum of the two muſt then be multiplied into the Differential of the third, thus. Suppoſe vxy, let $vx = t$, then $vxy = ty$, conſequently $d\ (v\,x\,y) = tdy + ydt$: But $dt = vdx + xdv$. Theſe Values therefore being ſubſtituted in the antecedent Differential, $tdy + ydt$, the Reſult is $d\ (v\,x\,y) = vdxy + vydx + xydv$, hence 'tis eaſy to apprehend how to proceed, where the Quantities are more than three,

If one variable Quantity x increaſe, while the other y decreaſes, 'tis evident $ydx - xdy$ will be the Differential of $x\,y$.

To difference Quantities that mutually divide each other, the Rule is: Firſt, Multiply the Differential of the Diviſor into the Dividend, and on the contrary, the Differential of the Dividend into the Diviſor: Subtract the laſt Product from the firſt, and divide the Remainder by the Square of the Diviſor; the Quotient is the Differential of the Quantities mutually dividing each other. See *Fluxion*.

CALCULUS *Exponentialis*, is a Method of differencing exponential Quantities, and ſumming up the Differentials or Fluxions of *Exponentials*:

By *Exponential Quantity* is here underſtood, a Power whoſe Exponent is variable, *v. g.* x^x, a^x.

To difference an *Exponential Quantity*, there is nothing required, but to reduce the *Exponential Quantities* to *Logarithmic* ones; which done, the differencing is managed as in *Logarithmic Quantities*, thus: Suppoſe the Differential of the *Exponential Quantity* $x\,y$ required, let

$$\begin{array}{c} x\,y = 3 \\ \text{Then will } \overline{y\,l\,x = l\,3} \\ \overline{l\,x\,y}\,\overline{d\,x : x = d\cdot 3 : 3} \\ 3\,l\,x\,d\,y + 3\,y\,d\,x : x = d\,3 \\ y - 1 \end{array}$$

That is, $\times\, y\,l\,x\,d\,y + y\,x$ by $d\,x = d\,3$. See *Exponential.*

CALCULUS *Integralis*, is a Method of integrating or ſumming up Fluxions and Differential Quantities; *i. e.* from a Differential Quantity given of finding the Quantity, from whoſe Differencing the given Differential reſults; the *Integral Calculus* therefore is the Inverſe of the *Differential* one; whence the *Engliſh*, who uſually call Differentials *Fluxions*, give this *Calculus*, which aſcends from the *Fluxions* to the flowing or variable Quantities; or, as Foreigners expreſs it, from the Differences to the Sums, by the Name of the *Inverſe Method of Fluxions*: See *Fluxions*. Hence the Integration is known to be juſtly perform'd, if the Quantity found according to the Rules of the *Differential Calculus*, being differenced, produce that propos'd to be ſumm'd: See *Summatory Calculus.* Suppoſe s the Sign of the Sum or *Integral Quantity*, then $s\,y\,d\,x$ will denote the Sum or *Integral* of the Differential $y\,d\,x$.

To integrate or ſum up a Differential Quantity: 'Tis demonſtrated, firſt, that $s\,d\,x = x$. Secondly, $s\,(d\,x + d\,y) = \overline{x + y}$. Thirdly, $s\,(x\,d\,y + y\,d\,x) = x\,y$. Fourthly, $s\,(m\,x\,m - 1\,d\,x) = x\,m$. Fifthly, $s\,(n : m)\ x\ (n - m) : m\,d\,x = x\,n : m$. Sixthly, $s\,(y\,d\,x - x\,d\,y) : y^2 = x\,y$. Of theſe the fourth and fifth Caſes are the moſt frequent, wherein the Differential Quantity is integrated, by adding a variable Unity to the Exponent, and dividing the Sum by the new Exponent, multiplied into the Differential of the Root, (*v. g.* in the fourth Caſe, by $m - 1 + 1$) *i. e.* by $m\,d\,x$.

If the Differential Quantity to be integrated don't come under any of theſe Formula's, it muſt either be reduced to an *Integrable Finite*, or an *Infinite Series*, each of whoſe Terms may be ſumm'd.

It may be here obſerv'd, that, as in the Analyſis of Finites, any Quantity may be rais'd to any Degree of Power; but, *vice verſa*, the Root cannot be extracted out of any required: So in the Analyſis of Infinites, any variable or flowing Quantity may be differenced: but, *vice verſa*, any Differential cannot be integrated: And as in the Analyſis of Finites we are not yet arriv'd at a Method of extracting the Roots of all Equations, ſo neither has the *Integral Calculus* arriv'd at its Perfection: and as in the former we are oblig'd to have Recourſe to Approximation, ſo in the latter we have Recourſe to Infinite Series, where we cannot attain to a perfect Integration.

CALCULUS *Literalis*, or *Literal Calculus*, is the ſame with *Specious Arithmetic*; ſo called from its uſing the Letters of the Alphabet in Contradiſtinction to *Numeral Arithmetic*, which uſes Figures. In the *Literal Calculus* given Quantities are expreſs'd by the firſt Letters, *a b c d*, and Quantities ſought, by the laſt, *x y z*, &c. Equal Quantities are denoted by the ſame Letters.

CALENDAR, or *Almanack*, is a political Diſtribution of Time accommodated to Uſe, and taken from the Motions of the Heavenly Bodies: Of this kind are thoſe annual Books wherein the Days of the Month, the Feſtivals, the Sign the Sun is in, the Sun's Riſing and Setting, the Changes of the Moon, *&c.* are exhibited; which we alſo call *Almanacks*. But the Word *Calendar* ſeems to come from the *Calendæ*, which, amongſt the *Romans*, were the firſt Days of every Month.

There have been many Corrections and Reformations of the *Calendar*: The firſt was made by *Numa Pompilius*; and this afterwards was much improved by *Julius Cæſar*, and was by him called the *Julian Account*, which in our Nation, and ſome other Places, is ſtill retained, and is called *Old Style.*

Pope *Gregory* the XIIIth pretended to reform it again, and ordered his Account to be currant, as it ſtill is in the *Roman Catholick Countries*; where it is ſtill called the *Gregorian Calendar*, and with us, *New Style.* It now begins 11 Days before ours.

A particular Account of the Nature of the *Julian* and *Gregorian Account*, ſee in a Book called, *The* Julian *and* Gregorian *Year*: And how both are pretended to be reform'd, ſee in a ſtitch'd Pamphlet, called, *The Reformed Calendar: Printed for* Sam. Manſhip, *at the* Ship *near the* Royal-Exchange, Cornhil, 1701.

CALENDAR *Aſtronomical*: See *Aſtronomical Calendar.*

CALENDS: So the *Romans* called the firſt Days of every Month, from the *Greek* Word καλέω, *voco, to call*; becauſe anciently, counting their Months by the Motion of the Moon, there was a Prieſt appointed to obſerve the Times of the New Moon; who, having ſeen it, gave Notice to the Preſident over the Sacrifices, and he called the People together, and declared unto them how they muſt reckon the Days until the *Nones*, pronouncing five times the Word καλέω, if the *Nones* happened on the 5th Day; or ſeven times, if they happened on the 7th Day of the Month.

CALENTURE [in *Medicine*] an Inflammatory Fever attended with a Delirium, in which the diſeaſed Perſon fancies the Sea to be green Fields; and if they are not hinder'd, will leap overboard.

CALIBRE, or *Caliper*, is the Bigneſs, or rather Diameter, of a Piece of Cannon, or of any Fire Arms, at the Mouth.

CALIBRE, CALLIPER, [with *Architects*] is uſed for the Bulk, Thickneſs, or Diameter, of a Column, or any round thing, thus: They ſay, theſe two Columns are of the ſame *Calibre*, i. e. the ſame Diameter.

CALIDUM *innatum*, innate Heat, is that Attrition of the Parts of the Blood, which is occaſioned by its circular Motion, and eſpecially in the Arteries. *L.*

CALIPERS, is an Inſtrument made like a Sliding-Rule, to embrace the two Heads of any Caſk, to find the Length. There are alſo the Gunners *Calipers* or *Compaſſes*, for finding the Diameter of the Ball, and Bore of a Gun.

CALIPER *Compaſſes*, are Compaſſes uſed by Gunners, with crooked or bowing Legs, to meaſure the Diameters of Bullets, and Cylinders of Guns.

CALIX [in *Botany*] the green Cup out of which the Flower comes, or that outward Greeniſh Part, which encompaſſes or defends the Foliage or Leaves of a Flower.

CALKING, or *Cauking of a Ship*, is driving in Oakam, or ſomething of that kind, into the Seams of the Planks, to prevent the Ship's Leaking.

CALKING, CALQUING, [in *Painting*] is a Term us'd where the Backſide of any Deſign is covered with a Black or Red Colour, and the Strokes or Lines trac'd thro' on a ſound Plate, Wall, or other Matter.

CALLICREAS: See *Pancreas*.

CALLIGRAPHY [Καλλιγραφία, *Gr.*] the Art of fair and handſome Writing.

CALLIPPICK *Period*, was an Improvement of the *Cycle of Meton* of 19 Years, which *Callippus*, a famous *Grecian* Aſtronomer, finding in reality to contain 19 of *Nabonaſſor*'s Years, 4 Days and $\frac{331}{499}$, he, to avoid Fractions, quadrupled the *Golden Number*, and by that means made a new *Cycle* or *Period* of 76 Years; which Time being expired, he ſuppoſed the Lunations or Changes of the Moon would all happen on the ſame Day of the Month, and Hour of the Day, that they were on 76 Years before.

CALLOSITY [in *Surgery*] a little *Callus* form'd in any Part of the Skin; or, a white, ſolid, dry, inſenſible Fleſh, generated by the Congeſtion of a dry pituitous Excrement, covering the Circumference of a Wound, Ulcer, *&c.* and in the Place where the good Fleſh ſhould grow.

CALLOUS, [*Calloſus*, *L.*] A Swelling is ſaid to grow *Callous*, when 'tis hardened, as ſometimes the Lips of a Wound. This is derived from

CALLUS, which is a kind of Swelling without Pain, like Skin contracted by too much Labour. *Blanchard.* *L.*

CALOTTE [in *Architecture*] a round Cavity or Depreſſure, in form of a Cap or Cup lathed and plaiſtered, uſed to diminiſh the Riſe or Elevation of a moderate Chapel, Cabinet, Alcove, *&c.* which would otherwiſe be too high, or other Pieces of the Apartment. *F.*

CALTHROPS: See *Chauſe-trapps*, or *Cows-feet*.

CALVA, the hairy Scalp, or upper Part of the Head, which, either by Diſeaſe or old Age, grows bald firſt.

CALX, [in *Chymiſtry*] is that which is produced by Burning or Calcination (which ſee) of any Metal or Mineral in a Crucible, *&c.*

CALX is the ſecond Bone in that Part of the Foot which ſucceeds the Ankle, bigger and ſtronger than the reſt, oblong, and grows backward, that a Man may ſtand more ſtrongly upon it, and not fall ſo eaſily backward.

CALX alſo is that, which, by calcining, is either turn'd into a *Coal*, as *Calx Saturni*, or at leaſt is made friable, as *Harts-Horn* burnt.

CALX *of Antimony*: See *Antimonium Diaphoreticum*.

CALX *of Gold*: Tho' it hath been look'd upon as a Thing of great Difficulty, yet the noble Mr. *Boyle* tells us, That if you grind well together a thick *Amalgama* of Gold and Mercury, with at leaſt an equal Weight of finely powdered Sulphur, and then put the Mixture to ſublime in a proper Glaſs, there will riſe, by Degrees of Fire, a Cinnabar; and this will leave behind it a finer *Calx of Gold* than is to be had by ſome far more difficult Proceſſes. See the *Mechan. Product of Volatility*.

CALYX [in *Botany*] ſignifies the Cup which contains, or encloſes, the Flower of any Plant; and ſometimes 'tis uſed for the Flower itſelf, when its Figure is like that of a Roſe, and not yet having its Leaves expanded.

CAMAIEU, [with *Painters*] a Term us'd when there is only one Colour, and where the Lights and Shadows are manag'd on a Gold or Azure Ground. This Work is chiefly uſed to repreſent *Baſſo relievo's*. The Name is borrowed from a Stone called *Camaieu* or *Cameus*, in *Latin*; the Orientals call it the *Onyx Camachuia*. This Stone is found with various Figures and Repreſentations of Landskips, *&c.* form'd by a kind of *Luſus naturæ*, ſo as to exhibit Pictures without Painting.

CAMAROSIS [in *Architecture*] a raiſing with an Arch or Vault.

CAMAROSIS [in *Surgery*] a Blow or Fracture upon the Skull, where ſome Part of the Bone is left hanging up, or ſtruck into the Form of an Arch.

CAMBER *Beam* [in *Architecture*] is a Beam, or Piece of Timber, cut hollow, or arching in the Middle. They are uſed in Platforms, Church-Leads, *&c.* and are very proper where-ever there is Occaſion for long Beams, being much ſtronger than flat Beams of the ſame Size; for, being laid with the hollow Side downwards, and having good Butments at the Ends, they ſerve for a kind of Arch.

CAMBRING, the Sea-men ſay, a Ship lies *Cambring*, when it doth not lie level, but higher in the Middle than at either End: Alſo, if her Keel is bent in in the Middle upwards, (which may happen from her lying a-ground on a Place where neither her Aft nor Fore-part do touch it, and from many other Reaſons taken from her Make) they ſay, She is *Camber-keel'd*.

CAMERA *Obſcura*: See *Obſcura Camera*.

CAMERATION [in *Surgery*] the ſame as *Cameroſis*.

CAMISADO, an Attack made upon an Enemy by Night, the Soldiers having their Shirts over their Apparel and Arms.

CAMPAIGN, is a Military Term, ſignifying the Space of Time during which Armies are maintained every Year in the Field. So a Man is ſaid to have made twenty Campaigns, when he hath ſpent ſo many Years in War-like Service in the Field.

CAMP *Flying*, is a ſtrong Body of Horſe and Foot commanded uſually by a Lieutenant General, which is always in Motion, both to cover our own Garriſons, and to keep the adverſe Army in continual Alarm.

CAMPANIFORM, [of *Campana* a Bell, and *forma*, *L.*] a Term uſed of Flowers which are in the Shape of a Bell.

CANAL, is a Word frequently uſed by Anatomical Writers, to ſignify a Channel or Paſſage, thro' which any Juices or Fluids of the Body flow.

CANAL *of a Larmier* [in *Architecture*] the Hollow, Platform, or Soffit, of a *Cornice*, which makes the pendant *Mouchette*.

CANALES *Semicirculares* [*Anatomy*] are three Canals in the Labyrinth of the Ear: They are of three different Sizes, *Major*, *Minor*, and *Minimus*: In different Subjects, they are frequently different, but are always alike in the ſame. *L.*

CANALICULUS *Arterioſus*, is a Veſſel betwixt the Arterious Vein in the Lungs, and the great Artery in the *Fœtus*; for 'tis obliterated in Adult Perſons: Its Uſe in *Fœtus's* is, that the Blood may be diſcharged by this *Ductus*, out of the Arterious Vein into the great Artery, becauſe that the Blood is not accended in the Lungs, for want of Reſpiration in the Womb.

CANCER, [in *Aſtronomy*] one of the 12 Signs of the *Zodiack*, drawn on the Globe in Form of a Crab, and thus marked ♋ Thro' the Beginning of this Sign paſſes a Circle parallel to the Equinoctial, called, the *Tropick of Cancer*, or the *Northern Tropick*; to which Circle, when the Sun comes, it makes the *Summer Solſtice*, and is turning his Courſe back again towards the Equinoctial. See *Sign* and *Conſtellation.*

The Stars in the Conſtellation of *Cancer*, *Ptolemy* makes 13, *Tycho* 15, but Mr. *Flamſtead* no leſs than 71.

CANCER, an Ulcerous Diſeaſe. Se *Carcinoma.*

CANCRINI *verſus*, Verſes that may be read either backwards or forwards, and are the ſame as,

Roma tibi ſubito motibus ibit amor.

CANDITEERS, [in *Fortification*] a Sort of Frames to lay Faggots and Bruſhwood upon, for covering the Men while at Work.

CANICULA, the ſame with *Canis Minor.*

CANINA *Fames*, or *Dogs-Appetite*, is an inordinate Hunger, attended with a Vomiting and a Looſeneſs, which proceeds from a depraved Action of the Stomach, craving Food in a greater Meaſure than Nature requires.

CANINI, are two Teeth in each Jaw, one on each Side of the *Inciſivi*; they are pretty thick and round, and they end in a ſharp Point; they have each one Root, which is longer than the Roots of the *Inciſivi*; their proper Uſe is, to pierce the harder kinds of Meat.

CANINUS, a Muſcle of the Lip, ſerving to put the Lips upwards.

CANIS *Major & Minor*, the greater and leſſer Dog, are two Conſtellations of Stars drawn upon the Globe, in Figure of this Animal; and the greater of them hath in his Mouth that vaſt Star called, *L.*

CANICULUS, or, the *Dog-Star*, which riſing and ſetting with the *Sun*, from about the 24th of *July* to the 28th of *Auguſt*, gives Occaſion to that Time, which is uſually very hot and ſultry, to be called, the *Canicular*, or *Dog-Days. L.*

CANIS *Major*, the *Great Dog*, [in *Aſtronomy*] a Conſtellation of the Southern Hemiſphere.

The Stars in the Conſtellation *Canis Major*, *Ptolemy* makes 28, *Tycho* obſerved only 13: In the *Britannick Catalogue* they are 32.

CANIS *Minor*, *Caniculus*, or the *Little Dog*, [in *Aſtronomy*] a Conſtellation of the Southern Hemiſphere, called, by the *Greeks*, *Procyon.*

The Stars in the Conſtellation *Canis Minor*, in *Ptolemy's* Catalogue, are 2, in that of *Tycho Brahe* 5, in the *Britannick* Catalogue 15.

CANNA *Major.* See *Tibia.*

CANNA *Minor.* See *Fibula.*

CANNON. [The Name *Cannon*, as *Menage* ſuppoſes, is deriv'd of *Cannone* of *Canna*, a Cane or Reed, becauſe a *Cannon* is long, ſtrait, and hollow, like a Cane.] The firſt *Cannons* were called *Bombards*, of *Bombus*, *L.* by reaſon of the Noiſe they made.

The Invention of *Cannon* is aſcrib'd, by *Larrey*, to *J. Owen*, who ſays, that they were firſt known in *England*, in the Year 1335; but yet acknowledges that they were known before; and writes, that in the Year 1346, there were 5 Pieces of *Cannon* in the *Engliſh* Army, at the Battle of *Creſſy*, and that theſe are the firſt that were known in *France.* And *Mezeray* relates, that K. *Edward*, by 5 or 6 Pieces of *Cannon*, ſtruck Terror into the *French* Army, it being the firſt time they had ſeen ſuch thundering Machines.

The Matter, of which Cannons are made, is Metal, either Iron or Braſs, or rather a Mixture of Copper, Tin, and Braſs. The Mixture of Tin is deſign'd to make the Metal more compact and denſe; ſo that, by how much the Copper is the heavier, it requires ſo much the leſs Tin.

It is uſual to add 8 Pound of Braſs, and 10 Pound of Tin, to 100 Pound of Copper: But ſometimes they uſe 10 Pound of Tin, 10 Pound of Lead, and 5 Pound of Braſs.

The *Swedes*, in the long War in the laſt Century, are ſaid to have uſed Cannons made of Leather: But theſe were too apt to burſt, to be of any great Effect.

The Parts and Proportions of Cannon about 11 Foot long, are: The Barrel, or Cavity, 9 Foot; its Fulcrum, or Support, 14; and its Axis 7; the Diameter of the Bore, at the Mouth, 6 Inches 2 Lines, the Plag of the Ball 2 Lines: The Diameter of the Ball therefore 6 Inches, and its Weight 33½ Pound; the Metal about the Mouth 2 Inches, and at the Breech 6; the Charge of Powder from 18 to 20 Pound. It will carry a Point-blank 600 Paces, and may be loaded 10 Times in an Hour, and ſometimes 15; 120 Times in a Day. The Bed of it is 15 Foot broad, and 20 long, for the Rebound. It requires 20 Horſes to draw it.

Cannons are diſtinguiſhed by the Diameters of the Balls they carry. The Rule for their Length, *&c.* That it be of ſuch a Length, as that the whole Charge of Powder be on Fire before the Ball quit the Piece. If it be made too long, the Quantity of Air to be drawn out before the Ball, will give too much Reſiſtance to the Impulſe; and that Impulſe ceaſing, the Friction of the Ball againſt the Surface of the Piece, will take off from the Motion.

In former Days Cannon were made much longer than they are now; but ſome being, by Chance, made 2½ Foot ſhorter than ordinary, it was found, that the Ball moves with a greater *Impetus* thro' a leſs Space than a larger. As *Guſtavus Adolphus* found by Experience, in the Year 1624: An Iron Ball of 48 Pound Weight, being found to go farther from a new ſhort Cannon, than another Ball of 96 Pound out of a longer Piece: Whereas, in other Reſpects, it is certain, the larger the Bore and Ball, the greater the Range.

The greateſt Range of a Cannon is ordinarily fix'd at 45 Degrees: But Dr. *Halley* ſhews it to be at 44½. M. *S. Julien* adjuſts the Ranges of the ſeveral Pieces of Cannon, from the Weight of the Ball they bear, the Charge of Powder being always ſuppoſed to be in a *Subduple Ratio* to the Weight of the Ball.

Weight of a Leaden-Ball.	Horizontal Range.	Greateſt Range.
℔	*Paces.*	*Paces.*
33	600	6000
24	700	6000
16	800	8000
12	450	5000
8	400	1500
6	150	1500

Experience has taught, that two Cannons of equal Bore, but different Lengths, the Longer requires a greater Charge of Powder than the Shorter.

The ordinary Charge of a Cannon is, to have the Charge of its Powder half that of its Ball.

The Names of the ſeveral Cannons, their Length, their Weight, and that of their Ball, as they obtain among us, are as in the following Table.

Names of Cannon.	Weight of an Iron-Ball.		Weight of the Cannon.	Length of the Cannon.	
	℔	*oz.*	℔	*F.*	*In.*
Cannon Royal	48	0	6000	12	0
Demi-Cannon, large	36	0	6000	12	0
Demi-Cannon, ordinary	32	0	5600	12	0
Demi-Cannon, leaſt	30	0	5400	11	0
Culverin, largeſt	20	0	4800	12	0
Culverin, ordinary	17	5	4500	12	0
Culverin, leaſt	15	0	4000	11	0
Demi-Culverin, ordinary	10	11	2700	11	0
Demi-Culverin, leaſt	9	0	2000	10	0
Saker, ordinary	6	0	1500	10	0
Saker, leaſt	4	12	1400	8	0
Minion, largeſt	3	12	1000	8	0
Minion, ordinary	3	4	800	7	0
Falcon	2	8	750	6	0
Falconet	1	5	400	5	6
Rabinet	0	8	300	4	6
Baſe	0	5	200		

Cannon are made cylindrical, that the Motion of the Ball may not be retarded in its Paſſage, and that the Powder, when on Fire, may not ſlip between the Ball and the Surface of the Cannon, which would hinder its Effect.

Wolfius would have the Cannons always decreaſe, as it goes towards the Mouth or Orifice; becauſe the Force of the Powder always decreaſes in Proportion to the Space thro' which it was expanded.

The new Cannons, that are made after the *Spaniſh* Manner, have a Cavity or Chamber at the Bottom of the Barrel, which helps their Effect.

A Cannon is found to recoil two or three Paces after the Exploſion, which, by ſome, is accounted for from the Air's ruſhing violently into the Cavity, as ſoon as the Ball has been diſcharged: But the real Cauſe is, the Powder's acting equally upon the Breech of the Cannon and the Ball.

M. *S. Julien* ſays, that a Cannon Ball thrown to the Diſtance of 600 Paces, ſinks 9, 10, 11, 12, nay 13 Foot within Ground.

CANON, [in the *Eccleſiaſtical Law*] was originally a Book, wherein the Religious of every Convent had a fair Tranſcript of the Rules of their Order: Theſe were often read over to them as their local Statutes, and were thence called *Regula*, and *Canon*, their Rule.

CANON, [in *Muſick*] *Ptolemy* rejecting the *Ariſtoxenian* Way of meaſuring the *Intervals* in Muſick, by the Magnitude of the Tone, (which they ſuppoſed to be formed by the Difference between a *Diapente* and *Diateſſaron*) thought that Muſical Intervals ſhould be diſtinguiſhed according to the *Ratio's* or Proportions which the *Sounds terminating thoſe Intervals* bare one to another, when conſider'd according to their Degree, of being *acute* or *grave*, which was alſo before *Ariſtoxenus*, the old *Pythagorick* Way. *Ptolemy* therefore made the *Diapaſon* to conſiſt in a double *Ratio*, the *Diapente* in a *Seſquialteral*, and the *Diateſſaron* in a *Seſquiteſſaron*: And the Tone itſelf, (by which the *Diapente* and *Diateſſaron* differ) in a *Seſquioctave*, and all the other Intervals, according to the Proportion of the Sounds that terminate them.

Wherefore, taking for Canon (as 'tis called) a determinate Line of any Length, he ſhews how this Canon is to be cut accordingly, ſo that it may repreſent the reſpective Intervals: And this Method anſwers exactly to Experiment in the different Lengths of Muſical Chords. And from this Canon, *Ptolemy* and his Followers have been called *Canonici*, as thoſe of *Ariſtoxenus* were called *Muſici*.

There is a Tract called *Sectio Canonis*, attributed, but falſly, to *Euclid*; and which you will find at the End of his Works, in the *Oxford* Ed. *G. L.*

CANON, [in *Mathematicks*] is a Rule to ſolve all things of the ſame Nature with the preſent Enquiry: Thus every laſt Step of an Equation in *Algebra* is ſuch a *Canon*; and if turn'd into Words, is a Rule to ſolve all Queſtions of the ſame Nature with that propoſed. *Canon* alſo is the Word for the Tables of *Logarithms*, *Artificial Sines*, *Tangents*, and *Secants*, which are of admirable Uſe in *Trigonometry*. 'Tis alſo the Name of a Surgeon's Inſtrument, which they make uſe of when they ſew up Wounds.

CANONICAL *Equations*. See *Quadratick Equations*.

CANON-LAW is a Collection of Eccleſiaſtical Rules, Definitions, and Conſtitutions, taken from the Ancient, General, and Provincial Councils, the Writings and Reſolutions of the Fathers of the Church, and the Reſcripts of Popes. This Law is modelled according to the Form of the *Civil*, and is reduced into 3 Volumes. The firſt is called, the *Decrees of Gratian*, and is compoſed of the Ancient Canons, and collected from the Ancient Councils and Writings of the Fathers.

The 2d Volume is called, the *Decretals*; and doth contain the *Decretal Epiſtles* or *Reſcripts* of Popes, and chiefly from *Alexander* III. to *Gregory* IX. by whoſe Authority it was compiled.

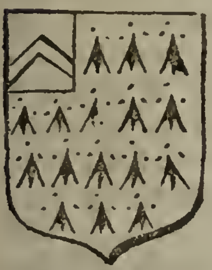
The 3d Volume is called *Sextum*, and contains the Reſcripts of the Popes from *Gregory* IX. to *Boniface* VIII. by whoſe Authority it was collected. To the End of this Volume are added, the *Clementina*, which are, the *Conſtitutions* of *Clement* V. enacted in the Council of *Vienna*; as alſo, the *Extravagants*, which are ſome Reſcripts of Pope *John* XXII. and ſome other Popes. They were called *Extravagants*, becauſe not contained in the Body of the *Canon-Law*, which is compoſed of the three lately mentioned Volumes.

CANT, [in *Carpentry*] a Term us'd when a Piece of Timber comes the wrong Way in their Work. They ſay, *Cant it*, i. e. Turn it about.

CANTALIVERS, [in *Architecture*] the ſame as *Modillions*, only thoſe are plain, but theſe are carved. They are both a kind of *Cartouzes*, ſet (at equal Diſtance) under the *Corona* of the Corniſh of a Building.

CANTHUS, or *Hircus*, is the Angle or Corner of the Eye; which is either the Greater, or the Internal; or the Leſs, or External.

CANTONED [in *Architecture*] is when the Corner of a Building is adorned with a Pilaſter, an Angular Column, Ruſtick Coins, or any thing that projects beyond the Naked of a Wall.



CANTON, an Ordinary in Heraldry, framed of two ſtrait Lines, one drawn perpendicularly from the *Chief*, and the other ſo from the Side of the Eſcutcheon. This is always leſs than a Quarter of the Field; and if drawn from the Left Corner of the Eſcutcheon, it is called a *Canton Siniſter* : Its Form is thus, He beareth *Ermin*, a *Canton Argent* charged with a *Cheveron Gules*, by the Name of *Middleton*.

CANVAS-BAGS, or *Earth-Bags*; *Sacs a Terre*, as the *French* call them, are, Bags holding about a Cubick Foot of Earth, and are uſed to raiſe a Parapet in haſte, or to repair one that is beaten down : They are chiefly uſed when the Ground is rocky, and affords no Earth to carry on the Approaches, then are theſe Bags of Earth very neceſſary, which can be filled at another Place, and removed at Pleaſure. Theſe Bags are ſometimes, upon Occaſion, filled with Powder, of which they hold about 50 ℔.

CAP [in a *Ship*] is a ſquare Piece of Timber, put over the Head, or upper End of any Maſt, having a round Hole to receive a Maſt. By theſe *Caps*, the Top-Maſts, and Top-Gallant-Maſts, are kept ſteady and firm in the *Treſſel-Trees*, where their Feet ſtand, as thoſe of the lower Maſts do in the *Steps*. They call alſo that Piece of Lead which is put over the Touch-hole of a great Gun, and keep the Prime from being waſted or ſpilt, the *Cap* of the Gun.

CAP-SQUARES, are broad Pieces of Iron on each Side of the Carriage of a great Gun, and lock'd over the Trunnions of the Piece with an Iron Pin : Their Uſe is, to keep the Piece from flying out of the Carriage, when 'tis ſhot off with its Mouth lying very low; or, as they call it, *under Metal*.

CAPACITY [in *Law*] ſignifies the Ability of a Man, or Body Politick, to give or take Lands, or other things, or ſue Actions.

CAPACITY [in *Geometry*] is the ſolid Content of any Body : Alſo our hollow Meaſures for Wine, Beer, Corn, Salt, *&c.* are called *Meaſures of Capacity*.

CAPE, is a Writ Judicial, touching Plea of Lands or Tenements, and divided into *Grand-Cape*, and *Petit-Cape*; both which take hold of things immovable, and ſeem to differ in this, that the *Grand-Cape* lieth before Appearance, and *Petit-Cape* afterwards.

CAPE, or *Promontory*, is any high Land running out with a Point into the Sea, as *Cape-Verde*, *Cape-Horn*, the *Cape of Good-Hope*, &c.

CAPE *Parvum*, is a Writ that lieth in caſe where the Tenant is ſummoned in Plea of Land, and cometh at the Summons, and his Appearance is recorded; and after he maketh Default at the Day that is given to him, then this Writ ſhall go for the King. *L.*

CAPE *ad valentiam*, is a Writ of Execution, or a *Species* of *Grand Cape*, ſo called of the End whereunto it tendeth : In the *Old Nat. Brev.* it is thus deſcribed: This Writ lieth, where any is impleaded of certain Lands, and he vouches to warrant another, againſt whom the Summons *ad warrantizandum* hath been awarded, and the Vouchee comes not at the Day given; then if the Demandant recover againſt the Tenant, he ſhall have his Writ againſt the Vouchee, and ſhall recover ſo much, in Value, of the Vouchee's Land, if he have ſo much; and if he have not ſo much, then the Tenant ſhall have Execution, by this Writ, of ſuch Lands and Tenements as deſcend to him in Fee-ſimple; or, if he purchaſe afterwards, the Tenant ſhall have againſt him a Re-ſummons, and if he can ſay nothing, he ſhall recover the Value. *L.* Note, *This Writ lies before Appearance.*

CAPELLA, a bright fix'd Star in the Left Shoulder of *Auriga*, whoſe *Longitude* is 77 *Degr.* 16 *Min.* *Latitude* 22 *Degr.* 50 *Min.* *Right Aſcenſion*, 73°. 7′.

CAPIAS is a Writ of two Sorts, one before Judgment, called, *Capias ad Reſpondendum*, in an Action perſonal, when the Sheriff, upon the firſt Writ of Diſtreſs, returns, *nihil habet in ballivo noſtra*; and the other is a Writ of Execution after Judgment, which are of divers Kinds, as theſe following. *L.*

CAPIAS *conductos ad proficiſcendum*, is a Writ for taking up ſuch as, having received Preſt Money to ſerve the King, ſlink away, and come not in at the Time. This is an Original Writ directed to the Serjeant at Arms, to arreſt and bring them in, having included a Clauſe of Aſſiſtance. *L.*

CAPIAS *pro fine*, is, where one being by Judgement fined unto the King, upon the ſame Offence committed againſt a Statute, doth not diſcharge it according to the Judgment, for by this is his Body taken and committed to Priſon, until he content the King for his Fine. *L.*

CAPIAS *ad Satisfaciendum*, is a Writ of Execution after Judgment, lying where a Man recovers in an Action perſonal, as Debts, or Damages, or *Detinue*, in the King's Court, and he againſt whom the Debt is recovered, hath no Lands nor Tenements, nor ſufficient Goods, whereof the Debt may be levied : For in this Caſe, he that recovereth ſhall have this Writ to the Sheriff, commanding him, that he take the Body of him againſt whom the Debt is recovered, and he ſhall be put in Priſon until Satisfaction be made. *L.*

CAPIAS *utlegatum*, is a Writ of Execution which lieth againſt him that is out-law'd upon any Suit, by which the Sheriff, upon the Receipt thereof, apprehendeth the Party out-law'd for not appearing upon the *Exigent*, and keepeth him in ſafe Cuſtody till the Return of the Writ, then bringeth him into Court, there further to be ordered for his Contempt. *L.*

CAPIAS *utlegatum & inquiras de bonis & catallis*, is a Writ all one with the former, but it gives a farther Power to the Sheriff, beſides the Apprehenſion of his Body, to enquire of his Goods and Chattels. *L.*

CAPIAS *in Withernamium de homine*, is a Writ that lieth for a Servant in *Withernam*. *L.*

CAPIAS *in Withernam de Averiis*, is a Writ that lieth for Cattle in *Withernam*. *L.*

CAPILLACIOUS [with *Botaniſts*] a Term uſed of ſuch Plants whoſe Leaf is cut into fine ſoft Threads, like Hairs, as *Fennel*, *Dill*, &c.

CAPILLAMENTS, [*Capillamenta*, *L.*] are thoſe ſmall Threads or Hairs (whence the Word) which grow up in the Middle of a Flower, and are adorned with little Knops at the Top : Thoſe Knops are called, the *Apices* of a Flower; and theſe *Capillaments* are called, the *Stamina*.

CAPILLARY *Plants* are, ſuch as have no main Stalk or Stem, but grow to the Ground, as Hairs to one's Head, and which bear their Seeds in little Tufts, Bunches, or Protuberances, on the Back-ſide of their Leaves, whence by ſome they are called

Dorſiparæ and *Tergifœtæ*. And theſe are either with an

Undivided Leaf, as the *Hæmionitis*, and the *Phyllytus*; or with a

Singly divided Leaf; and theſe have the Leaf either cut or jagged in, but not divided into *Pinnæ*, clear home to the main Rib, as, *Polypodium*, *Lonchitis*, *Scolopendria*, *Adianthum*, *Acroſticon*: Or elſe,

Divided quite home to the Rib, and hanging like *Pinnæ*; as, the *Chamæfilix Marina*, and the *Trichomanes*: Others have the Leaf

Doubly divided, or at leaſt, *once ſub-divided*; the firſt Diviſion being into *Branches*, and the 2d into *Pinnæ*; as, the *Hemionites Multifida*, the *Filix mas*, the *Filix Paluſtris*, *Filix Saxatilis*, the *Adiantum Album*, and *Nigrum*: And others have the Leaf

Trebly divided, or thrice ſub-divided, *viz.* Firſt into Branches, then into little Twigs, and after this into *Pinnæ*; and theſe are the *Filix Scandens* of *Braſile*, the *Filix Florida* or *Oſmunda Regalis*, the *Filix mas Ramoſa*, the *Filix Femina Vulgaris*, the *Adiantum Album Floridum*, and the *Drypoteris Nigra*. Ray's *Hiſtoria Plantarum*.

CAPILLARY *Tubes* [in *Phyſicks*] are little Pipes whoſe Canals are the narroweſt poſſible; not ſuch, whoſe Diameters do not exceed that of a common Hair; for none ſuch can be made. The Diameter of Capillary Tubes, is, a Half, Third, or Fourth of a Line: See *Tube*.

The Aſcent of Water, *&c.* in Capillary Tubes, is a famous Phænomenon, which has long embaraſſed the Philoſophers: Let one End of a ſmall Tube, open at both Ends, be immerg'd in Water, and the Liquor within the Tube will riſe to ſome ſenſible Height above the external Surface: Or, immerge two or more Tubes in the ſame Fluid, one of them a Capillary one, and the other conſiderably larger, the Water will aſcend conſiderably higher in the Capillary Tube than in the other; and this in the reciprocal *Ratio* of the Diameters of the Tubes. This Effect, Authors have commonly imputed to the unequal Preſſure of the Air in unequal Tubes: The Air, ſay they, conſiſts of ramoſe ſpongy Parts, intermingled and embaraſs'd among each other: Now, a Column of ſuch Air being ſuppoſed perpendicularly incumbent in the Canal of a ſmall Capillary Tube, Part of the Preſſure of the Column will be ſpent on the Sides or Surface of the Tube; ſo that the Column will not act with its whole Weight on the ſubjacent Fluid, but will loſe a greater or leſs Proportion of its Weight, as the Diameter of the Tube is the ſmaller; but this Solution is deſtroyed, by the Experiments ſucceeding in *vacuo*, as well as in open Air. Others, as Mr. *Hauksbee*, *&c.* have Recourſe to the Attraction of the Annuli of the concave Surface of the Tube; to which Opinion the ingenious Dr. *Morgan* ſubſcribes. Part of the Gravity of the Water in the Tube, ſays that Author, being taken off by the attractive Power of the internal concave Surface of the Glaſs, the Fluid within the Tube, by the external greater Weight or Preſſure, muſt aſcend ſo far as to compenſate for this Diminution of Gravity, by the Attraction of the Glaſs. He adds, That as the Power of Attraction in Tubes is, in a reciprocal *Ratio* of the Diameters, by leſſening the ſaid Diameter, or by ſuppoſing the Tubes ſtill ſmaller and ſmaller. Water, or any other Fluid, may be thus raiſed to any aſſignable Height, *Phil. Princ. of Medicine, p.* 88, *&c.*

But this Author is ſomewhat overſeen: For ſince in every Capillary Tube, the Height to which the Water will ſpontaneouſly aſcend, is reciprocally, as the Diameter of the Tube, it follows, that the Surface containing the ſuſpended Water is always a given Quantity; but the Column of Water ſuſpended in every Tube, is as the Diameter of the Tube; therefore, if the Attraction of the containing Surface be the Cauſe of the Water's Suſpenſion, it will follow, that equal Cauſes produce unequal Effects, which is abſurd; and again, not only his Solution, but his Phænomenon alſo, is ſtretch'd too far: For 'tis not in all Fluids the Phænomenon obtains; but in Mercury the very contrary is found, the Fluid in a Tube not riſing ſo high as the Level of that in the Veſſel, and the Defect being found the greater as the Tube is ſmaller.

We muſt therefore recur to Dr. *Jurin*'s Solution of this Phænomenon, which is well ſupported by Experiments: The Suſpenſion of the Water, on that Gentleman's Syſtem, is owing to the Attraction of the Periphery of the concave Surface of the Tube, to which the upper Surface of the Water is contiguous and adheres. This being the only Part of the Tube from which the Water muſt recede upon its ſubſiding, and conſequently the only one which, by the Force of its Coheſion and Attraction, oppoſes the Deſcent of the Water; this he ſhews to be a Cauſe proportional to the Effect, in regard the Periphery, and the ſuſpended Column, are both in the ſame Proportion as the Diameter of the Tube, the Suſpenſion thus accounted for, the ſeemingly ſpontaneous Aſcent will eaſily be ſolved; for ſince the Water that enters a Capillary Tube as ſoon as its Orifice is dipp'd therein, has its Gravity taken off by the Attraction of the Periphery, with which its upper Surface is in Contact, it muſt neceſſarily riſe higher, partly by the Preſſure of the ſtagnant Water, and partly by the Attraction of the Periphery, immediately above that which is already contiguous to it: See *Aſcent*.

CAPILLARY *Veſſels*, ſmall Veins and Arteries, like Threads or Hairs.

CAPILLATION, according to ſome Writers, is a Fracture in the Skull, ſo ſmall that it can ſcarce be found, which yet often proves mortal.

CAPITATÆ *Plantæ* [in *Botany*] are ſuch Plants whoſe Flowers are compoſed of many edged and hollow little Flowers; and Mr. *Ray* calls them by this Name, becauſe their ſcaly Calyx (or Cup of the Flower) moſt uſually ſwells out into a large and round Belly, containing within it the pappous Seed, as, *Carduus*, *Centaury*, *Knapweed*, *Cinara*, *Cirſium*, *Lappa major*, *Cyanus*, &c.

CAPITAL [in *Architecture*] is a principal and eſſential Part of an Order of Column or Pilaſter, and is different in different Orders, and is that which chiefly diſtinguiſhes and characterizes the Orders.

The *Corinthian* CAPITAL is much the richeſt, it has no Ovolo, and its *Abacus* is very different from thoſe of the *Dorick*, *Ionick*, and *Tuſcan*; it has its Faces circularly hollowed upwards, having a Roſe in the Middle of each Sweep. It has only a Brim and a Vaſe inſtead of an Ovolo, and Annulets, the Neck being much lengthened and inriched with a double Row of eight Leaves in each, bending their Heads downwards, ſmall Stalks ariſing between, from whence the Volutes ſpring; but they reſemble not thoſe of the *Ionick* Capital, which are 16 Inches inſtead of 4 in the *Ionick*, on each Side 4, under the 4 Horns of the *Abacus*, where the 4 Volutes meet in a ſmall Leaf, which turns backwards towards the Corner of the *Abacus*. Theſe

Leaves are divided, each making 3 Ranges of leſſer Leaves, whereof they are compos'd; again, each leſſer Leaf is ſometimes parted into 3, called *Laurel Leaves*; but generally into 5, called *Olive Leaves.* The middle Leaf, which bends down, is parted into Eleven. In the Middle, over the Leaves, is a Flower ſhooting out between the Stems and Volutes, like the Roſe in the *Abacus.* The Height of this Capital is $2\frac{2}{3}$ Modules, and its Projecture $1\frac{7}{8}$.

According to *Vitruvius*, the Height of this Capital (by the Aſtragal at the Bottom) is equal to the Diameter of the Body of the Column below, $\frac{1}{7}$ Part of which goes to the *Abacus* (which conſiſts of a *Boultin*, a *Fillet*, and a *Plinth* (which is but a larger Fillet) the *Abacus* being ſub-divided into 3 Parts, one of them goes to the *Boultin*, and a third Part of the next goes to the Fillet, and the reſt to the Plinth. The Height of the Aſtragal below the Capital, is $1\frac{1}{2}$ Part of the Diameter of the Body of the Column below, and is divided into 3 Parts, whereof the *Fillet* contains one Part, and the *Boulton* two.

Scammozzi makes this Capital $1\frac{1}{6}$ Diameter of the Column high, which divided into 75 Parts, 4 of them go to the *Boultin*, 1 to the *Fillet*, and 9 to the *Plinth*, and the reſt to the Neck.

Palladio alſo makes the Height of this Capital equal to the whole Diameter of the Body of the Column below, and $\frac{1}{6}$ Part more, which is allow'd to the *Abacus*, by which he is ſuppoſed to mean all the Mouldings above the Acanthus Leaves.

The *Tuſcan* Capital is the moſt ſimple and unadorned, its Members or Parts are no more than three. An *Abacus*, and under this an *Ovolo*, or Quarter-round; and under that, a Neck or *Collarine*, the Neck terminates in an *Aſtragal* or Fillet, belonging to the Fuſt or Shaft. The Character of this Capital, whereby it is diſtinguiſhed from the *Dorick*, &c. is, that the *Abacus* is ſquare and quite plain, and has no Ogee, or other Moulding; and that there are no Annulets under the *Ovolo.* Authors indeed do not agree as to the Character of the *Tuſcan* Capital. *Vignola* gives the *Abacus* a Fillet inſtead of an Ovolo, *Serlio* only a Fillet, *Vitruvius* and *Scammozzi* add an *Aſtragal* and *Fillet* between the Ovolo and Neck: But the Aſtragal of the Shaft is confounded with that of the Capital. The Height of this Capital is the ſame with that of the Baſe, *viz.* one Module or Semidiameter; its Projecture is equal to that of the Cincture at the Bottom of the Column, *viz.* $\frac{1}{4}$ of the Module. According to *Vitruvius*, the Height of this Capital (by the *Aſtragal* at the Bottom) muſt be Half the Diameter of the Body of the Column below. And this Height being divided into three Parts, the firſt and the uppermoſt Part goes to the *Abacus* (which is a ſquare or flat *Mouldin*) the ſecond Part goes to the *Boultin* and Fillet under it, (the *Boultin* is a Quarter of a Circle, the Fillet a narrow flat *Moulding*) and this Part is ſub-divided into 4 Parts, of which 3 go to the *Boultin*, and one to the *Fillet*, and the third and laſt Part goes to the Neck, which is flat and ſtreight: Again, the Neck is divided into two Parts, one of which is the Breadth of the *Aſtragal* under it, (which conſiſts of a Semicircle and a Fillet under it;) the *Aſtragal* is again divided into 3 Parts, of which 2 go to the Semicircle, and one to the Fillet, the Projecture of the Capital ſhall be $\frac{2}{8}$ Part of the Diameter of the Body of the Column below. The *Aſtragal* projecteth in a Square.

According to *Scammozzi*, the Height of the Capital (by the *Aſtragal* at the Bottom) muſt alſo be $\frac{1}{2}$ the Diameter of the Column below, and this Height being divided into 60 Parts, 20 of them ſhall go to the *Abacus*, (or *Plinth* as he calls it) 15 to the *Echinus* or Half-round (which *Vitruvius* calls the *Boultin*,) 5 to the *Rondel*, or *Bead-moulding*, (which is a Semicircle) 3 to the *Liſt* (which *Vitruvius* calls a *Fillet*,) and 17 to the Neck or Frieze (as he calls it:) Again, 7 ſuch Parts muſt go to the Roundel of the *Aſtragal*, and 8 to its *Liſt*.

According to *Palladio*, the Height of the Capital is alſo Half the Diameter of the Body of the Column below, *viz.* by the *Aſtragal*, (which none of them reckon a Part of the Capital, tho' in Propriety of Speech it ought to be ſo eſteem'd;) and this Height is divided into 3 equal Parts, the uppermoſt of which goes to the *Abacus* (which he alſo calls the *Dado*, or *Dye*,) the next Part goes to the *Ovolo* or *Echinus*, (*Vitruvius* calls it the *Boultin*) the other Part is divided into 7, of one of which is made the *Liſtella* (*Vitruvius* calls it the *Fillet*) under the *Ovolo*, and the other 6 Parts go to the *Collarino* or Neck, (he alſo calls it the *Hypertrachelium* or Frieze of the Capital.

The *Compoſit* CAPITAL takes its Name from being compoſed of Members borrow'd from the Capitals of other Columns.

From the *Dorick* it takes a Quarter-round, or *Ovolo*; from the *Ionick*, an *Aſtragal* under this, together with Volutes or Scrolls; from the *Corinthian*, a double Row of Leaves, and in moſt other things reſembles the *Corinthian*, generally conſiſting of the ſame Members and the ſame Proportion.

There is a Flower in the Middle of the *Abacus*, and Leaves which run upwards under the Horns, as in the *Corinthian.* It has Flowers, inſtead of Stalks in the *Corinthian*, lying cloſe to the Vaſe or Bell, which twiſt themſelves towards the Middle of the Face of the Capital. The Height of this Capital is $2\frac{1}{2}$ Modules, and its Projecture $1\frac{2}{3}$ Module as in the *Corinthian.*

The *Dorick* CAPITAL, [beſides an *Abacus*, an *Ovolo*, and a *Neck*, in common with the *Tuſcan*] has 3 Annulets, or little ſquare Members, underneath the *Ovolo*, in place of the *Aſtragal* in the *Tuſcan*, and a *Talon*, *Cima*, or *Ogee*, with a Fillet over the *Abacus.*

According to *Vitruvius*, the Height of the *Dorick* Capital (by the *Aſtragal* at the Bottom) is equal to $\frac{1}{2}$ the Diameter of the Body of the Column below: And this Height being divided into 8 Parts, the firſt and lowermoſt goes to the Neck, the next Part goes to the *Boultin*, (by which Term he here comprehends ſeveral Members, and deſcribes this Part in two Forms: 1 Of which is is a *Boultin*, as 'tis deſcribed *N.* 2. and 3 Fillets under it; and the other is a *Boultin* and *Aſtragal* under it) and this Part is divided into 3 Parts, 2 of which go to the *Boultin*, properly properly ſo called, and the other to the 3 Fillets, or to the *Aſtragal*; the Fillets are all of an equal Size; in the *Aſtragal* the Fillet is $\frac{1}{3}$ of the whole. The third and the uppermoſt Part of the Capital is again divided into 3, the 2 lowermoſt of which go to the Square, and the other to the *Cimatium* (which is an *Ogee*, with the Hollow downwards) and a Fillet over it.

An *Ogee* is a Moulding ſomething reſembling an *S*, which *Vitruvius* makes of 2 Quarter-Circles joined together; and this *Cimatium* being alſo divided into 3 Parts, 2 of them go to the *Ogee*, and one to the *Fillet.*

Scammozzi makes the Capital of the ſame Height, which he divides into 60 Parts, of which 3 go to the Fillet of the *Cimatium*, 5 to the *Ogee* of the

Cimatium, 12 to the Square, 14 to the Boultin, 5 to the Rondel, and 2 to the Fillet of the *Aſtragal* under the Boultin, and 19 to the Neck. The *Aſtragal* under the Neck contains 10 ſuch Parts, of which $6\frac{1}{2}$ go to the Rondel, and $3\frac{1}{2}$ to the Fillet.

Palladio alſo makes the Capital of the ſame Height with *Vitruvius*, which he divides into 3 Parts, the uppermoſt of which he ſubdivides into 5 Parts, 2 of which go to the *Cimatium*, (which *Vitruvius* calls the *Cimatum*,) and is again ſubdivided into 3 Parts, one of which goes to the *Liſtella*, or *Annulet*, (which *Vitruvius* calls a *Fillet*) and the other 2 to the *Cima recta*, (which is an *Ogee*, as it is deſcrib'd in this Number) and the other 3 of the firſt Subdiviſion of this Part go to the *Abacus*, (which *Vitruvius* calls the *Square*) the Second of the 3 Grand Diviſions of the *Capital* is ſubdivided into 3 Parts, 2 of which go to the *Ovolo* or *Echinus*, (which *Vitruvius*, N 2. calls a *Boultin*) and the other to the Annulets under it, which are 3, and are equal. The third principal *Hypotrachelium*, or *Frieze*, (which *Vitruvius* calls the *Neck*) the Aſtragal under the Neck, is as high as all the 3 Annulets.

The *Ionick* CAPITAL is compoſed of 3 Parts: An *Abacus*, which conſiſts of an Ogee and a Fillet, and under this a Rind, which produces the Volutes or Scrolls, which is the moſt eſſential Part of this Capital. The Aſtragal which is under that *Ovolo*, belongs to the Shaft, and the middle Part is call'd a Rind or Bark, becauſe of its bearing ſome Reſemblance to the Bark of a Tree laid on a Vaſe, the Brim of which is repreſented by the *Ovolo*, and ſeems to have been ſhrunk up in drying, and to have twiſted into the Volutes; the *Ovolo* is adorn'd with Eggs, ſo called from their Oval Form. The Height of this Capital ſome reckon 18 Minutes, and its Projecture $\frac{7}{10}$.

The *Ionick*, according to *Vitruvius*, is made thus: Divide the Semi-diameter of the Body of the Column below into 18 Parts, of which 3 muſt go to the *Cimatium*, one to the *Fillet*, and two to the *Cima* (or *Ogee*) under it; then take 4 Parts for the *Trochilus* of the Volute or Scroll; (the *Trochilus* is that Member from whence the Scroll begins) then take 4 Parts from the *Boultin*, (which is $\frac{1}{4}$ of a Circle) which muſt be carv'd with Eggs and Anchors; then take 2 Parts for the *Aſtragal* under the *Boultin*. The *Aſtragal* is carved with Beads, and has a Fillet on each Side of it, each $\frac{1}{4}$ of the whole. Then the 6 remaining Parts muſt go to the Half of the Volute below. Then take 8 more ſuch Parts, which muſt go to the Remainder of the Frieze or Neck of the Capital, and 3 more ſuch Parts for the *Aſtragal* under the Neck, of which one Part goes to the Fillet.

Palladio's Deſcription agrees with *Vitruvius*'s; but *Scammozzi*'s is obſcure, and being ſcarce intelligible, I ſhall omit it.

The Differences in the Management of this Capital ariſe chiefly from the different Management of the Volutes; that in the Antique, and ſome of the Modern, the Eye of the Volute does not anſwer the Aſtragal at the Top of the Shaft, as it is made by *Vitruvius*, and moſt of the Moderns; that the Place of the Volutes which uſually makes a Flat, is ſometimes curv'd and convex'd, ſo as that the Circumvolutions go advancing outwards, as is frequent in the Antique; that the Border or Rim of the Scroll in the Volute is ſometimes not only a plain Sweep, as ordinarily; but the Sweep is accompanied with a Fillet.

That the Leaves that inveſt the Balluſter are ſomething long and narrow, ſometimes larger and broader.

That the two Faces of the Volutes are ſometimes joined at the outer Corner, the Balluſters meeting at the inner, to make a Regularity between the Faces on the Front and the Back of the Building with thoſe of the Sides.

That ſince *Scammozzi*, among the Moderns, the *Ionick* Capital has been altered, and the 4 Faces made alike, by taking away the Balluſter, and hollowing all the Faces of the Volutes inwards, as in the *Compoſite*.

That *Scammozzi*, and ſome others, make the Volutes to ſpring out from the *Ovolo*, as from a Vaſe, after the Manner of a modern *Compoſite*; whereas in the Antique, a Bark paſſes between the *Ovolo* and *Abacus*, quite ſtraight, only twiſting at its Extremities to form the Volute.

And laſtly, That of late Years the Sculptors have added a kind of little Feſtoons ſpringing from the Flower, the Stalk of which lies on the firſt Circumvolution of the Volute, which is ſuppoſed to repreſent the Locks of Hair hanging down on both Sides of the Face.

An *Angular* CAPITAL is that which bears the Return of the Entablature at the Corner of the Projecture of a Frontiſpiece.

CAPITAL of a *Balluſter* is that Part which crowns the Balluſter, which ſometimes bears a Reſemblance to the Capitals of ſome Columns, and particularly the *Ionick*.

CAPITAL of a *Niche*, is a kind of little Canopy over a ſhallow Niche, that covers or crowns a Statue.

CAPITAL of a *Triglyph*, is the Platband over the *Triglyph*, which *Vitruvius* calls the *Tænia*. It is alſo ſometimes a *Triglyph* that does the Office of a Capital to a *Dorick* Pilaſter.

CAPITAL of a *Baſtion* [in *Fortification*] is a Line drawn from the Angle of the Polygon to the Point of the Baſtion, or from the Point of the Baſtion to the Middle of the Gorge. Theſe Capitals are from 35 to 40 Fathom long; that is to ſay, from the Point of the Baſtion to the Place where the two Demigorges meet.

CAPITAL *Line*: See *Line*.

CAPITAL, or *Chapital*, or *Chapiter*, ſignifies [in *Architecture*] the Top of a Pillar; and this is different, according to the different Orders.

CAPITE is a Tenure that holds immediately of the King, as of his Crown, be it by Knight-ſervice or Soccage, and not of any Honour, Caſtle, or Mannor.

CAPITULUM [in *Botanicks*] is the Head or Flowering Top of any Plant, being compoſed of many Flowers and Threads (or *Stamina*) cloſely connected in a Globous, Circular, or Diſcous Figure; as, the Flowers of *Blew-bottles*, *Scabius*, *Carduus*, &c.

CAPONNIERE [in *Fortification*] is a covered Lodgment of about 4 or 5 Foot broad, encompaſſed with a little Parapet of a above two Foot high, which ſerves to ſupport the diverſe Planks laden with Earth.

This Lodgment is large enough to contain 15 or 20 Soldiers. and is uſually placed upon the Extremity of the Counterſcarp, having ſometimes ſeveral little Embraſures made therein, commonly called *Mardreſſes*. They are generally on the Glacis or in dry Moats.

CAPRÆ *Saltantes*, is the Term for a fiery Meteor or Exhalation, which ſometimes appears in the Atmoſphere, and is not fired in a ſtrait Line, but with Inflexions or Windings in and out.

CAPREOLARIA *Vaſa*, [in an *Animal Body*] are ſuch as twine about like the *Capreoli* or Tendrils of Vines.

CAPREOLUS [in *Botany*] is the Claſp or Tendril by which the Vines, and ſuch like creeping Plants faſten themſelves to thoſe things which are deſigned to ſupport them.

CAPREOLATÆ *Plantæ*, are ſuch Plants as turn, wind, and climb along the Surface of the Ground, by means of their *Capreoli* or Tendrils; as *Gourds*, *Melons*, *Cucumbers*, &c.

CAPRICORN [in *Aſtronomy*] one of the Signs of the *Zodiack*, mark'd thus, ♑. See *Sign*.

The Antients accounted *Capricorn* the 10th Sign, and when the Sun arrived thereat, it made the Winter Solſtice, with regard to our Hemiſphere: But the Stars having advanced a whole Sign towards the Eaſt, *Capricorn* is now the 11th Sign; and 'tis at the Sun's Entry into *Sagittary* that the Solſtice happens, tho' the antient manner of ſpeaking is ſtill retained. This Sign is repreſented, on antient Monuments, Medals, *&c.* as having the Fore-part of a *Goat*, and the Hind-part of a *Fiſh*, which is the Form of *Ægypan*; ſometimes ſimply under the Form of a *Goat*.

The Stars in the Conſtellation *Capricorn*, in *Ptolemey*'s and *Tycho*'s Catalogues, are 28; Mr. *Flamſtead*, in the *Britannick* Catalogue, makes near double the Number, *viz.* 51.

CAPSTAN; or, as the *French* write it, *Cabeſtan*, others *Capſtand*, [of a *Ship*] is of two Kinds, the *Main Capſtan*, and the *Jeer Capſtan*.

The *Main Capſtan* is that Piece of Timber which is placed next behind the Main-maſt; its Foot, or lower End, ſtandeth in a Step on the lower Deck, and its Head is between the two upper Decks: its ſeveral Parts are thus called; the ſmalleſt Part of it, the *Spindle*; the Brackets ſet into the Body of the *Capſtan*, cloſe under the Barrs, they call, the *Whelps*; the main Subſtance or Poſt of the whole Piece, is, the *Barrel*, through which the Barrs go; the *Pawl* is a Piece of Iron bolted to one End of the Beams of the Deck, cloſe to the Body of the *Capſtan*, to keep the *Capſtan* from turning back, and this Stoppage they call, *Pawling the Capſtan*: The Uſe of the *Capſtan* is, to *weigh* the Anchors, to *hoiſe up*, or *ſtrike down*, Top-maſts, to *heave* any weighty thing, or to *ſtrain* any Rope that requireth main Force.

The *Jeer Capſtan* is placed in the ſame manner as the *Main Capſtan*, between the Main-maſt and Fore-maſt; and its Uſe is, chiefly, to *heave* upon the *Jeer Rope*, (which ſee) or to heave upon the Viol, and to hold off by when the Anchor is weighing.

The Terms belonging to the Uſe of the *Capſtan's* are: *Come up Capſtan*, that is, ſlack the Cable which you heave by; in which Senſe alſo they ſay, *Launch out the Capſtan*. *Paul the Capſtan*, is, ſtop it from going back, as was above hinted.

CAPSULA *Communis*, of *Gliſſon*, is a Membrane proceeding from the *Peritonæum*, and including both the *Porus Bilarius* and the *Vena Portæ*, in the Liver.

CAPSULA *Seminalis*, [in *Botany*] is the Caſe or Husk that holds the Seed of any Plant.

CAPSULÆ *Atrabilariæ*, the ſame with the *Renes Succenturiati*: Which ſee.

CAPSULÆ *Seminales* [in *Anatomy*] are the extreme Cavities of the Veſſels which convey the *Semen* in an Animal Body; they are dilated like little Coffers, which by two ſmall Holes emit the *Semen* received from the Teſticles into the little Seminary Bladders, that it may either be preſerved there againſt the time of Coition, or be reduced into Blood by the Lymphatick Veſſels. *Blanchard.* See *Teſtes* and *Teſticle*.

CAPSULATE *Plants*, are ſuch as have a *tretapetalous regular Flower*, conſiſting of 4 diſtinct *Petala* in each Flower, and which bear their Seeds in ſhort *Capſulæ*, by which they are diſtinguiſhed from the *Siliquoſæ*, which bear their Seed in *long Caſes*, or *Capſulæ Seminales*, and are the other Branch of this Genus of Plants.

CAPTION, when a Commiſſion is executed, and the Commiſſioners Names ſubſcribed, and returned, that is called the *Caption*.

CAPUT *Gallinaginis*, [in *Surgery*] *i. e. Cock's-Head*, a kind of Septum or ſpongeous Border at the Extremities of the Apertures of each of the *Veſiculæ Seminales*, ſerving to hinder the Seed comeing from one Side, from ruſhing upon, and ſo ſtopping the Diſcharge of the other. *L*

CAPUT *Mortuum* is that thick dry Matter that remains after Diſtillation of any thing, but of Minerals eſpecially; and very commonly it denotes only that which remains of Vitriol in its Diſtillation, which they call *Colcothar Vitrioli*: See *Earth* and *Terra Damnata*. This *Caput Mortuum*, tho' in ſome Caſes there be but little, if any, active Principle left in it, yet is never pure, and the *Colcothar Vitrioli*, if expoſed to the Air, will turn to *Vitriol* again.

CARACOL [in *Architecture*] a Stair-caſe in a Helix or Spiral Form.

CARACT, CARAT, is not any certain Weight or Quantity, but the $2\frac{1}{4}$ Part of any Quantity of Weight: And the Minters and Goldſmiths divide it into 4 Parts, which they call *Grains of a Caract*, and one of theſe they divide into Halfs and Quarters.

If an Ounce of Gold be ſo pure, that in its Purification (with Antimony, or otherwiſe) it loſes nothing at all; 'tis then ſaid to be Gold of 24 *Carats*: If it loſe one Carat, 'tis then Gold of 23 *Carats*: And if it loſe two Carats in its Purification, 'tis called Gold of 22 *Carats*, &c. But perhaps there is no ſuch thing as Gold of 24 *Carats*; for it will retain ſome ſmall Portion of Silver or Copper, putrify it as long as you will.

CARAT *of Diamonds*, *Pearls*, or *Precious Stones*, is the Weight of 4 Grains only.

CARBUNCULATION is, the blaſting of the new ſprouted Buds of Trees or Plants, either by exceſſive Heat, whereby the Texture of the Fibres of the Vegetable are ſo diſſolved, that its Pores become wholly changed; or elſe by exceſſive Cold, which compreſſes its Fibres ſo, that the Pores thereby are ſhut up, and leave no Paſſage for the Alimentary Juice. *L.*

CARBUNCULUS, the ſame with *Anthrax*.

CARCASE *of a Houſe* [with *Architects*] are the Partitions, Floors, Rafters, *&c.*

CARCASS, or *Carcus*, [in *War*] a kind of *Bomb*, uſually oblong or oval, rarely circular, conſiſting of a Shell, or Caſe (ſometimes of Iron) with Holes; more commonly of a coarſe ſtrong Stuff, pitch'd over, and girt with Iron Hoops, fill'd with combuſtible Matters, as, Hand-Granades, Ends of Muſkets, loaded Piſtols, and Preparations of Gun-

Powder, *&c.* Its Uſe is, to be thrown out of a Mortar, to ſet Houſes on Fire, and do other Execution.

For the Compoſition of a Carcaſs, to burn, *Wolfius* preſcribes, 10 Parts of Gun-powder pounded, 2 of Nitre, 1 of Sulphur, and 1 of Colophony : Or, 6 of Gun-powder, 4 of Nitre, 4 of Sulphur, 1 of beaten Glaſs, $\frac{1}{2}$ of Antimony, $\frac{1}{2}$ of Camphire, 1 of Sal-Armoniac, and $\frac{1}{4}$ of Common Salt : For the Shell, or Caſe, he takes 2 Iron Rings, (ſome chuſe Plates) fitting one, at one Extreme, near the Aperture at which the *Carcaſs* is to be fir'd, and the other, at the other : Others make the Aperture in one of the Plates ; theſe he braces with Cords drawn length-ways ; and acroſs theſe, at Right-angles, laces others, making a Knot in each Interſection : Between the Folds of the Cords he makes Holes, and into theſe fits Copper Tubes, filling them half full of Powder and Leaden-Bullets, rammining the whole with Tow, *&c.* The Shell thus prepared, he immerges it (the Aperture firſt ſtopt) in a liquid Matter, conſiſting of 4 Parts of melted Pitch, 20 of Colophony, 1 of Oil of Turpentine, and as much ground Gun-powder as will reduce it to the Conſiſtence of a Paſte. After Immerſion, it is to be cover'd over with Tow, and immerg'd a-freſh, till it become of the Bigneſs proper for the Mortar.

CARCASS is, an Iron Caſe, or hollow Capacity, about the Bigneſs of a Bomb, ſometimes made all of Iron (except two or three Holes through which the Fire is to blaze) and ſometimes made only of Iron Bars or Hoops, and then covered over with pitched Cloth, Hemp, *&c.* and filled with ſeveral kinds of Materials for firing of Houſes ; they are thrown out of Mortar-pieces, like Bombs, into beſieged Places, *&c.*

CARCINODES, [Καρκινώδης, *Gr.*] a Tumour reſembling a Cancer. *Blanchard.*

CARCINOMA, [Καρκινώμα, of Καρκίνὸς and Νέμω, *Gr.* to feed upon,] *Carcinus*, or *Cancer*, is a Tumour that ariſes round, hard, livid, and painful ; at the Beginning as big as a Pea, but afterwards it is ſurrounded with great ſwelling Veins, which reſemble the Feet of a Crab, (though not always) whence the Name. *Blanchard.*

CARD. See *Chard.*

CARDIACA is, a Suffocation of the Heart from a polypus or coagulated Blood. *Blanchard.*

CARDIACUM [a *Cordial*] is a Medicine which (as they were formerly thought) corroborates the Heart ; but it rather only puts the Blood into a fine gentle Fermentation, whereby the Spirits formerly decayed, are repaired and invigorated, ſo that the Blood, by conſequence, circulates more eaſily and briskly.

CARDIACUS *Plexus*, is a Branch of the eighth Pair of Nerves, or the *Par Vagum*, which, about the firſt or ſecond Rib, is ſent from its deſcending Trunks, and is beſtow'd upon the Heart and its *Appendage.*

CARDIALGIA, [Καρδιαλγία, of καρδία and ἄλγος, *Gr.* Pain] is a gnawing Pain ſometimes felt in the *Scrobiculus Cordis* : Or, as *Blanchard* ſaith,

CARDIALGIA, and *Cardiogmos*, the *Heartburning*, is a Gnawing or Contraction of the Nerve called *Par Vagum*, and the Intercoſtal implanted in the Stomach, proceeding from a pungent vellicateing Matter in the Ventricle ; ſo that the Heart being ſtraitened and contracted, by Conſent, with the Stomach, occaſions ſometimes a ſwooning away.

CARDINAL *Winds* or *Points*, are, the *South*, *Weſt*, *North*, and *Eaſt* Points of the Compaſs ; and alſo, the Equinoctial and Solſtitial Points of the Ecliptick are called, the *Four Cardinal Points.*

CARDINAL *Signs*, are thoſe Signs of the *Zodiack* called, *Aries*, *Libra*, *Cancer*, and *Capricorn.*

CARDIOGMOS, the ſame with *Cardialgia.*

CAREEN : A Ship is ſaid to be brought to a *Careen*, when the moſt Part of her Lading, *&c.* being taken out, there is laid, by her Side, another Ship or Veſſel lower than her, unto which ſhe is haled down as low as Occaſion requires, as, to the 4th or 5th Strake, and there kept, by the Weight of Ballaſt, Ordinance, *&c.* as well as by Ropes, leſt it ſhould ſtrain her Maſts too much. 'Tis done with a Deſign to trim her Sides or Bottom, to caulk her Seams, or to mend any thing that is in fault under Water : And from hence, if a Ship ly on one Side when ſhe ſails, they ſay, *She lies on the Careen.*

CARIATIDES. See *Caryatides.*

CARIES is, the Corruption of a Bone from the continual Afflux of vicious Humours, or from their Acrimony and Malignity, or from a Bruiſe that ſome way affects the Bones, or from ſharp Medicines, *&c.* *Blanchard.*

CARINA is, a Term us'd both by Anatomiſts, for the firſt Rudiments of the entire *Vertebræ*, as they appear in a Chicken's Embryo, while it is in the Shell, becauſe it is crooked in the Form of the Keel of a Ship : And alſo the Botaniſts, for the ſame Reaſon, uſe the Word *Carina*, to expreſs the lower *Petalum* of a *Papillionaceous* Flower. The Leaves alſo of the *Aſphodelus*, they ſay, are *Carinated.*

CARLING *Knees*, are thoſe Timbers which go athwart the Ship, from her Sides to the Hatchway, and which bear up the Deck on both Sides.

CARLINGS, are Timbers in a Ship, lying Fore and Aft, along from one Beam to another : On theſe the Ledges reſt, on which the Planks of the Deck are made faſt. All the *Carlings* have their Ends let into the Beams, which is called *Culvertail.*

CARMINATIVE *Medicines*, are Remedies that diſpel or diſcuſs Wind, either by appeaſing the Fermentations that occaſion it, or by making it thin, and opening the Pores, that it may be expelled. *Blanchard.*

CARNATION is a Term in Painting, ſignifying ſuch Parts of an Human Body as are drawn naked, without any Drapery, or which expreſs the bare Fleſh ; and when this is done natural, bold, and ſtrong, and is well coloured, they ſay of the Painter, that his *Carnation* is very good.

CARNEL : The Building of Ships, firſt with their Timber and Beams, and after bringing on their Planks, is called, *Carnel-work*, to diſtinguiſh it from *Clinch-work.* Thoſe Veſſels alſo which go with Mizen-ſails inſtead of Main-ſails, are by ſome called *Carnels.*

CARNIVOROUS *Animals*, are ſuch as feed on Fleſh wholly, or chiefly.

CARNOSITY is a more than ordinary Fleſhineſs in any Part of the Body. Some Authors uſe it for, a little fleſhy Excreſcence, or Tubercle, when formed in the *Urethra*, or Neck of the Bladder or Yard, which ſtops the Paſſage of the Urine.

CARNOUS, Fleſhy ; whence the *Membrana Carnoſa*, or *Panniculus Carnoſus*, takes its Name, which is a fleſhy Membrane covering the whole Body.

CARO [the Fleſh of an *Animal Body*] is, by Anatomiſts defined to be a ſimilar and fibrous Part, ſoft and thick: They account it Five-fold: 1. *Muſcular, Fiſtular*, or *Fibrous*, as is the Subſtance of the Heart, and other Muſcles. 2. *Parenchymous*, as the Lungs, Liver, and Spleen, were thought to be by the Ancients; but, ſince the Uſe of Glaſſes, 'tis plainly diſcovered, that there is no ſuch thing as a *Parenchyma*, properly ſpeaking, but that all the *Viſcera*, as well as the other Parts of the Body, are Vaſcular, and nothing but a Plexus or Net-work of ſmall Veſſels and Canals. They call the Fleſh of the Stomach and Guts, 3. *Viſcerous*; and they reckon a 4th Sort, which they call *Glandulous*, as is that of the Pancreas, the Tonſils, the Breaſts, *&c.* And 5. They call the Fleſh of the Lips, *Gums*; of the Glans of the Penis, *&c.* *Spurious*, as being of a different Conſtitution from all the reſt. *L.*

CARO, [in *Botany*] ſignifies the Pulp, Fleſh, or ſoft Subſtance, contained within any Plant, or its Fruit, ſuch as the Pulp of *Caſſia, Tamarinds, Prunes, &c.*

CAROTIDES, [Καρωτίδες, *Gr.*] are Arteries in an Animal Body ſo called; they ſpring from the aſcending Trunk of the *Aorta*, or great Artery, at the ſame Place, nearly where the Subclavian Arteries ariſe: Here the Trunk begins to be divided into two Branches, which are theſe *Carotides*; they aſcend directly upwards (tho' the Right ſometimes ariſe from the right *Subclavian*) and at their Riſe are ſuſtained by the *Thymus*; then having beſtow'd Twigs on the Larynx, Tongue, the Muſcles of the *Os Hyoides*, and the adjacent Glands, they paſs up on each Side, by the Sides of the Wind-pipe to the *Faucet*, together with the Internal Jugular-Vein, and there are ſubdivided into the External and Internal Branches.

The *External* is ſmaller, and is diſperſed into all the Muſcles of the Cheeks, Forehead, Temples, Lips, and, in general, thro' all the outer Parts of the Head and Face.

The *Internal*, which is larger, ſends firſt ſome more Twigs to the Larynx, Tongue, and ſo alſo to the Glands behind the Ears, and the ſpongy Parts of the Palate and Noſe; then it entereth the upper Jaw, and beſtows a ſmall Slip on the Root of each Tooth (as the *External* did on the Roots of the Teeth of the lower Jaw) whereby ſharp Humours flowing in upon them, ſometimes cauſe a very painful Tooth-ach. The Remainder of it climbs upon the Skull, being about its *Baſis* divided into two Branches; the Leſs and Hinder whereof, having ſent one Slip to the inner Muſcles of the Neck, and another thro' the Hole of the Uppermoſt *Vertebra*, into the Membrane that inveſts the Spinal Marrow, aſcending further, enters the Skull at the Hole by which the 6th Pair of Nerves (commonly called) comes out, and, creeping along the *Dura Mater*, ends near its *Sinus* (which yet ſome ſay it enters). The larger Branch, tending upwards, is carried thro' the bony Channel in the Wedge-like Bone, with a winding Duct, to the *Sella Equina*; at whoſe *Baſis*, after it hath ſent out a Twig on each Side into the *Dura Mater*, it opens itſelf into many ſmall Slips, which being interwoven with thoſe of the Cervical Artery (abovementioned) make the *Rete Mirabile*, which is more obſervable in Beaſts than in Men; yet it is not all ſpent on the ſaid Slips, but, perforating the *Dura Mater*, it enters the *Pia Mater*, with two notable Branches; which being divided into very ſmall Twigs, are mingled with thoſe of the Cervical Artery, which which they paſs out of the Skull, and accompany the Spinal Marrow even to the Loins: Afterwards it ſends a ſmall Branch thro' the ſecond Hole of the Wedge-like Bone, with the Optick Nerve, out of the Skull to the Eye; and yet ſtill ſupplying more Twigs to the Subſtance of the Brain and *Pia Mater*, and, being united with ſome other Twigs of the Cervical Artery, it makes the *Plexus Choroides*.

CARPENTRY, the Art of cutting, framing, and joining large Pieces of Wood, for the Uſe of Building.

CARPIA is, a Tent that is put into a Wound or Ulcer, to cleanſe it.

CARPUS, commonly *Brachiale*, the firſt Part of the Palm of the Hand: *Heſychus* calls it that Part of the Arm which is betwixt the lowermoſt Part of the Cubit and the Hand, or the Wriſt; it conſiſts of eight ſmall Bones, with which the Cubit is joined to the Hand. *Blanchard.*

CARTESIAN *Syſtem* of the World:

Mr. *Des Cartes*, in order to account for the Cœleſtial Appearances, ſuppoſes the Matter of the World to have been at firſt divided, by Almighty God, into *innumerable little equal Parts*, each endowed with an equal Degree of Motion, both about its own Centre, and ſeparately, ſo as that this Matter conſtituted a Fluid. He ſuppoſed alſo, that ſeveral Collections of this Matter were endowed with a Motion about different Points, as common Centres, which Points were placed at equal Diſtances; ſo as that the Matter round them compoſed different *Vortices*, as he calls them. He alſo ſuppoſes, that the firſt Particles of Matter, by thoſe inteſtine Motions, were rendered, or ground, of a Spherical Figure, and ſo did compoſe *Globules* of ſeveral Magnitudes; and theſe he calls, the *Matter* of his *Second Element*.

But the very ſmall Particles which, by the aforeſaid Motions, were ground and rubb'd off from the firſt Particles of Matter, and driven violently many different Ways, made up a new Matter, which he calls his *Firſt Element*. And ſeeing that there would be more of this firſt Element, than was ſufficient to fill the Vacuities between the *Globules* of the *Second Element*, he ſuppoſes, that the remaining Part would be driven towards the Centre, by the circular Motion of theſe Globules, which did, for that Reaſon, recede from it: And this Matter being there amaſſed into a Sphere, would, in the Centre of every Vortex, produce a Body like the Sun: Which Sun being thus form'd, and moving about its own Axis, with the common Matter of the *Vortex*, would neceſſarily throw out ſome Parts of its Matter, thro' the Vacuities of the Globules of the ſecond Element, conſtituting the *Vortex*, and this eſpecially at ſuch Places as are fartheſt from its Poles, receiving, at the ſame time, in, by theſe Poles, as much as it loſes in its Equatorial Parts, or about the Equator: And by this Means it would be able to carry round with it thoſe Globules that are neareſt, with the greater Velocity, and the Remoter with leſs: And by this Means thoſe Globules which are neareſt the Centre of the Sun, muſt be leaſt; becauſe, were they greater or equal, they would, by Reaſon of their Velocity, have a greater centrifugal Force, and recede from the Centre: And if it ſhould happen that any of theſe Sun-like Bodies in the Centres of the ſeveral *Vortices*, ſhould be ſo incruſtated and weakened, as to be carried about in the Vortex of the *True Sun*: If it were of leſs Solidity, or leſs Motion, than the Globules towards the Extremity of the *Solar Vortex*, then it would deſcend towards the Sun, till it met with Globules of the ſame Solidity, and capable of the ſame Degree of Motion with itſelf; and then being fix'd there, it would be for ever after carried about by the Motion of the *Vortex*, without either approaching any nearer to, or receding from the Sun, and ſo become a Planet.

Suppoſing then all this, we are next to imagine that our *Syſtem* was at firſt divided into ſeveral *Vortices*, in the Centre of each of which was a lucid ſpherical Body; and that ſome of theſe being gradually incruſtated, were ſwallowed up by others, which were larger and more powerful, till at laſt they were all deſtroyed and ſwallowed up by the biggeſt *Solar Vortex*, except ſome few which were thrown off in Right Lines, from one Vortex to another, and ſo became *Comets*: And from hence it appears, that thoſe *Planets* which are neareſt the Sun, are leſs ſolid; that is alſo, *Des Cartes*'s Reaſon why we ſee always the ſame Face of the Moon; becauſe the Hemiſphere, which is oppoſite to the Sun and the Earth, is ſomewhat more ſolid than the other; becauſe alſo, the Matter of the firſt Element, which makes up the Body of the Sun, moves with greater Velocity the Parts of the *Vortex*, and the Bodies ſwimming in it, than thoſe that are remoter: Therefore thoſe Planets which are nearer to the Sun, muſt finiſh their Periods ſooner than thoſe which are more remote from him: And the Reaſon why the Planets revolve round their Axis, is, becauſe (according to this Hypotheſis) they were lucid, Sun-like, and revolving Bodies before.

But, notwithſtanding all this fine Romance, it is (1*ſt*.) certain, that a *Vortex* produced by the Revolution of a Sphere about its Axis, muſt be propagated *in infinitum*, if nothing hinder it: And therefore, ſince there muſt be as many *Vortices* as there are fix'd Stars, one Vortex would certainly run into another, and every Particle would be acted by a Motion compounded of the Motion of all the central Spheres; which is abſurd, and contrary to that Conſtancy, Limitation, and Uniformity, which is obſerved in the *Phænomena* of the Heavenly Bodies.

2. Since the Motion and Parts of the *Vortices*, neareſt the Centre, is ſwifter than that of the more remote, they muſt preſs upon the exterior Parts, and thereby perpetually impart ſome Part of their Motion to them; and therefore, thoſe interior Parts of the *Vortex* will be continually leſſening ſome Part of their Motion, which never being reſtored, theſe Parts muſt ſtill move ſlower and ſlower, by Degrees, till at laſt all the Motion will be quite deſtroyed.

3. According to this Hypotheſis, each Planet is of the ſame Denſity with the Parts of the *Vortex* in which it ſwims, being governed by the ſame Laws of Motion, and is, as it were, only ſome concreted Parts of the *Vortex*. But the Times of the Periodical Motion of Bodies carried about by a Vortex, are in a duplicate Ratio of their Diſtances from their Centre; as the incomparable Sir *Iſaac Newton* hath demonſtrated in *Sect.* IX. of his *Princip.* Whereas the Squares of the Times of the Periodical Revolutions of the Planets are as the Cubes of their mean Diſtance from the Centre, or from the Sun: Wherefore the Planets cannot be carried about by a Vortex.

4. If a Vortex run out *in infinitum*, then would a Body carried round by it certainly deſcribe a perfect Circle, unleſs ſomething ſolid did hinder it; and therefore, the greater Diſtance there were between thoſe ſolid Bounds, or the larger the Baſon be which contains the Vortex, in reſpect of the Orbit of the Body carried about in it, the nearer would this Orbit be to a Circle; that is, the Excentricity of the Planets neareſt the Sun, would be leſs than that of thoſe which are more remote: But the direct contrary to this is true in Fact, the Excentricity of *Mercury* being greater than that of *Saturn*.

5. A Body carried about in a Vortex of the ſame Denſity with it, would neceſſarily deſcribe a Circle, to whoſe Plane the Axis of the central Body producing the Circulation of the Fluid, would be perpendicular: And yet there is not one Planet to the Plane of whoſe Orbit the Sun's Axis is perpendicular.

6. The Comets have their Orbits, not only oblique to, but ſometimes at Right Angles with the Plane of the Ecliptick; ſometimes the Courſe of theſe Comets is diametrically oppoſite to that of the Sun: They perſevere in their Motion, without any Change: By Lines drawn from them to the Sun, they deſcribe equal Areas in equal Times; and ſometimes they enter into the Vortex of the Sun. All which is impoſſible, if the *Solar Vortex* moved round forcibly enough to carry theſe vaſt Bodies of the Planets along with it.

Mr. *Leibnitz* hath indeed a little altered and mended this Hypotheſis of *Des Cartes*; he hath accommodated it better to the Cœleſtial Phænomena, and made it more agreeable to the Rules of Geometry.

And 1*ſt*. he ſhews, That all Bodies which, in a Fluid, deſcribe a Curve-Line, are moved by that Fluid; for of themſelves they would deſcribe Right Lines, and nothing (ſaith he) but the Fluid concurs to turn them out of the Way.

2*dly*. He endeavours to ſhew, that every Planet is carried about by a Motion compounded of two other Motions; *viz.* The Harmonical Circulation of the deferent Fluid, and the Paracentrical Motion of Acceſs to, or Receſs from, the Sun.

The Planets, by a Radius from the Sun, deſcribe Areas proportional to their Times; now the Fluid that carries the Planets, muſt of Neceſſity circulate ſo as to produce this Effect; which cannot be done otherwiſe than by ſuppoſing innumerable concentrical Orbits of exceeding Thinneſs, to make up the Vortex; every one of which hath its own proper Way of Circulation: *viz.* Thoſe Orbs which are neareſt the Sun move faſteſt, and the Velocities of the Circulations are every where reciprocally proportional to the Diſtances of the reſpective Orbs from the Sun, which will neceſſarily make the Planet to deſcribe equal Areas in equal Times, let it be in any Part of the Vortex: For theſe Areas are in a compounded Ratio of their *Radii* or Diſtances from the Sun, and in a reciprocal one of the Arches or Lengths of the Circulation, which in this Caſe will make a Proportion of Equality: And this Law of the Circulation of the Vortex, he calls *Harmonical*.

The *Paracentrick* Motion is compounded of two others; that is, the *Excuſſory* Impreſſion of the Harmonick Circulation, whereby all Bodies moving in a Curve, endeavour to recede from the Centre, by the Tangent; and the Attraction of the Sun, or the Planets Gravitation towards him. And this, Mr. *Leibnitz* is of Opinion, ariſes from an Impulſe communicated by the circulating Fluid. Now, ſince the Planets move in *Ellipſes*, in one of whoſe Foci the Sun is placed, and by Lines drawn from him, do deſcribe equal Areas in equal Times, which no other Law of a circulating Fluid, but the Harmonick Circulation can account for, we muſt find out a Law for the *Paracentrick* Motion, that may make the Orbits elliptical, the excuſſory Impreſſion of the circulating Fluid, would throw off the Planet from the Centre, by the Tangent, wherefore the Attraction of the Sun, or the Gravitation of the Planets towards it, muſt be ſufficient to deſtroy that Effect; and beſides, to make them move in Elliptick Orbits, which cannot be brought about, unleſs this Attraction or Gravitation be reciprocally as the Squares of the Diſtances from the *Focus*: And this is the Sum of Mr. *Leibnitz's* Improvement of this Hypotheſis.

But this Account muſt be falſe, for theſe Reaſons: 1ſt. Becauſe the Comets, as hath been ſaid before, have their Orbits, ſome of them very oblique too; nay, ſometimes at Right Angles with the Plane, or the Ecliptick, and their Courſes are ſometimes quite contrary to thoſe of the Planets. Now theſe Comets deſcribing about the Sun, Areas proportionable to the Times, muſt alſo, according to their Motion, be carried about by an harmonically circulating Fluid: But then we ſhall have *Vortices* moving contrary to *Vortices*, which is very abſurd.

2. In equable Motions, the Times are always *directly* as the Spaces, and *reciprocally* as the Velocities, but in a circular Motion, the Spaces in one Revolution are as the *Radii*; and in an Harmonical Circulation, the Velocities are reciprocally as the *Radii*, and therefore the Periodical Times of a Fluid circulating harmonically, are in a duplicate Proportion of the *Radii*; whereas the Periodical Times of the Planets are in ſeſquiplate Proportion of their Diſtances from the Centre, or of their *Radii*, and conſequently the Planets cannot be carried by an *harmonically circulating Fluid*.

It may, perhaps, be alledged here, That this harmonical Circulation is not continued from *Mercury* to *Saturn*, but is interrupted, and reaches only from the *Perihelion* of *Mercury* to his *Aphelion*, and is there again interrupted, and ſo on thro' the whole Syſtem of the Planets; but this would produce a Deformity, which is very unlike the ſimple uniform Meaſures of Nature every where elſe: And beſides, the Comets moving forward in the Zodiack, paſs thro' all theſe imaginary Chaſms and Interſtices, and yet move in the ſame Manner as if they were carried by a Fluid circulating harmonically, according to ſome uniform Law; neither do their Appearances give any Ground to ſuſpect ſuch Interruptions as theſe: *Vid. Dr.* Cheyne *Phil. Prin. of Natural Religion.*

CARTILAGE [*Cartilago, L.*] is a white Part, drier and harder than a Ligament, and ſofter than a Bone: It is, by ſome, ſaid to be a ſimilar and ſpermatick Part, but falſly; for 'tis no more made of Seed than any other Parts: It renders Articulation more eaſy, and defends ſeveral Parts from the Injuries from abroad. In aged Perſons, the Cartilages commonly grow bony.

They have a Membrane juſt like the *Perioſtæum*, and 'tis indeed but a Continuation of it.

CARTILAGO *Scutiformis*, is one of the 5 Cartilages of the *Larynx*; 'tis called, in *Greek*, θυρεοειδὴς, becauſe of its Figure. It makes that Protuberance in the Fore-part of the *Larynx*, called *Pomum Adami*. It is about one Inch broad, but not ſo long, being concave within, and convex without. Its 4 Angles have each a ſmall Production; the 2 upper, which are longer, are tied to the Horns of the *Os Hyoides*; and the 2 lower, to the ſecond Cartilage, which is called *Cricoides*, or *Annularis*, from its being like a Ring. *L.*

CARTONS [in *Painting*] are the moſt perfect Sort of Drawings on Paper, which are ſubſervient to great Works, that muſt be throughly finiſhed; all Sketches, Drawings, Models, and all other Works being preparatory only, and to be reduced to *Cartons*. This Way was practiſed by *Michael Angelo* and *Raphael Urbin*, *&c.* the *Cartons* of *Hampton-Court* being the Work of *Raphael*.

They are ſometimes made by meaſuring the Height and Breadth of the Place where the Painting is deſign'd to ſtand; and then, by dividing that Space into Squares, and one afterwards of the ſame Dimenſions on Paper: They draw on the latter the Subject of their Story or Deſign, transferring it afterwards from the *Carton* to the Wall, by painting it there in Oil, *&c.*

But ſome great and experienc'd Maſters will be able to do all this without the Help of the *Grate*, as they call it; that is, the Diviſion of the Space or Table into Squares, tho', after all, 'tis a good ſecure Way.

CARTOUCH is a Caſe of Wood about 3 Inches thick at the Bottom, girt round about with Marlin, and holding about 48 Musket Balls, beſides 6 or 8 Iron Balls of a Pound Weight. 'Tis fired out of a *Hobit*, as they call it; that is, a ſmall Mortar, and is very proper for defending a Paſs.

CARTOUZES [in *Architecture*] are much the ſame with *Modilions*, only theſe are ſet under the Corniſh in Wainſcoting, and thoſe under the Corniſh at the Eves of a Houſe. Some Workmen call them *Dentils*, or Teeth.

CARTRIDGES [or *Carthrages*] are Caſes of Paper; or, as they now are uſually made for the King's Ships, to prevent Danger from Fire in a Gun not well ſpunged, of Parchment, fitted exactly to the Bore of a Piece of Ordnance, and containing its due Charge of Powder. There are alſo Tin Cartridges, in which the Paper or Parchment ones, are both formed and carried.

CARUCATE [from *Caruca*; and the *French*, *Carui*] a Plough, was the Ancient *Plough-Land*, and ſignified, as much Arable-Land as could be tilled with one Plough in a Year. This, in *Richard* the Firſt's Reign, was computed at 60 Acres, but it was afterwards varied; and the Meaſure of a *Carucate* was different, according to the Time and Place.

CARUNCULÆ *Myrtiformes*, the Wrinklings of the Orifice of the *Vagina*, or Membranous Inequalities, not to be reckoned in any certain Number, which, in Women with-Child, and after Child-birth, are ſo obliterated, that they are altogether imperceptible: There are, for the moſt part, Four of them. *Blanchard.*

CARUNCULÆ *Oculi*, are Glandules placed at each great Corner of the Eye, which ſeparate Moiſture for moiſtening the Eyes, the ſame with Tears, which afterwards, by the *Puncta Lachrymalia* placed in the Bone of the Noſe, are diſcharged into the Noſtrils. Theſe are called *Carunculæ Lachrymales*, by ſome.

CARUNCULÆ *Papillares*, are 10 little Bodies that are in the Reins and Kidneys; they are properly little Bundles, which ariſe from the centring together of a great many ſmall Channels, which the Reins are in a great meaſure made up of; and thoſe receive the *Serum* from the little *Ductus's*, and convey into the *Pelvis*. *Blanchard.*

CARUS is, a Sleep, wherein the Perſon affected, being pulled, pinched, and called, ſcarce ſhews any Sign of either Hearing or Feeling: It is without a Fever, greater than a Lethargy, and leſs than an Apoplexy. *Blanchard.*

CARYATIDES [in *Architecture*] an Order of Pillars, in the Form of the Bodies of Women, with their Arms cut off, and cloathed in a Garment down to their Feet: Theſe Figures do ſupport the *Entablature.* There are ſome Columns of this Order is the Famous Building at *Bourdeaux*, called the *Tutelles*; and in the Great Hall of the *Swiſs Guards* at the *Louvre* in *Paris*, where four *Caryatides* ſupport a Gallery enriched with Ornaments very well cut.

The Riſe of this Order of Pillars was this: The Inhabitants of *Carya* in *Peloponneſus* did once treacherouſly join with the *Perſians* againſt their own Country; but the *Grecians* got the Battle, and put all the Male Inhabitants of *Carya* to the Sword, reducing the City to Aſhes. The Women they took Captives, and carried in Triumph: And the more to perpetuate the Memory of this baſe Action, they would not permit theſe Women ever to put off their Triumphal Veſtments, but ordered the Architects of thoſe Times to expreſs them in that Dreſs, as ſupporting the heavy Weight of their Edifices, inſtead of the uſual Columns.

The *Perſick Order* of Pillars had much the ſame Original; which ſee. *Vitruv. lib.* 2. *c.* 1.

The *Caryatides* are not now repreſented as formerly they were, with Hands ty'd before and behind, the Marks of Servitude and Slavery; ſuch Characters giving Diſguſt to the fair Sex: And for that Reaſon others are given them that are intirely oppoſite, they being never us'd in Building, but as ſingular Beauties, and ſuch as make the greateſt Ornament of it. They never appear now but under the noble Symbols of *Wiſdom*, *Juſtice*, *Prudence*, *Temperance*, *&c.* when the *Caryatides* are inſulate, they ſhould not have any Weight to ſupport greater than thoſe of Balconies; little Galleries, or ſlight Crownings, and their Entablature, may be *Ionick.*

The Ancients made the *Caryatides* frequently to ſupport Baskets or Corbels of Flowers, and theſe they called *Ciſtiferæ*, or *Caniferæ.*

Some are of Opinion, that the *Caryatides* being the Figures of Women, they don't ſeem altogether proper to do the Office of Columns; but it is eaſy to amend this when they join to the Wall, for then there needs no more than to place a Conſole over them, which ſhall appear to ſuſtain all the Weight of the Entablature: By this Means the *Caryatides* may ſerve for Columns, without being over burthened.

The *Cariates* may be uſed in Architecture of a Gallery or Salon, if they have a Projecture beyond the Wall, in the Manner of Pilaſters: But then they ſhould not be made to bear any thing but the Entablature, the Weight of the Wall being born by the Wall behind, which ſerves them as a Ground or Bottom.

The *Cariates* ought never to be made of an immoderate Stature, leſt, by their Bigneſs, they ſhould become frightful to Ladies. And ſome approve beſt of confining them under the Impoſts of a *Portico*, and then thoſe Impoſts will ſerve them for an Entablature: And alſo, when Occaſion offers, they may be raiſed on Pedeſtals, which ought not to be leſs than $\frac{1}{3}$ of their Height; and if there be Conſoles plac'd over their Heads beſides, then the Figures may be raiſed of a reaſonable Size.

The *Cariates* ought never to be uſed together with the common Columns, under the ſame Entablature; becauſe, there can never be a juſt Symmetry between them, and becauſe the Figures of Women as high as common Columns will be monſtrous, and render the Appearance of all the reſt of the Architecture mean and pitiful.

Some *Cariates* have their Arms cut off; but theſe kinds of Mutilations, which are only done to render the Figures more light and delicate, or rather, to render them more to the other Columns, are only proper for *Termini*, or Forms, which are a kind of Half-human Figures, which ſeem to proceed out of a *Vagina*, or Sheath.

Again, the *Caryatides* ſhould always appear in Characters proper to the Places in which they are uſed. As thoſe which ſupport the Crowning of a Throne ought to be Symbols or Repreſentations of Heroick Virtues. Thoſe which are placed in Halls and Banqueting-Rooms, ſhould appear with Countenances which ſhew Signs of Gladneſs and Rejoycing: And ſuch as ſerve as Columns in Places of Devotion, ſhould bear the Characters of Religion.

Nor will it be proper to uſe the *Cariates* in Figure of Angels, except it be at Baldagums and Altars, and then thoſe that appear under that Form, it may be proper that they ſupport the Entablature with their Heads, as tho' they ſuſtain'd it with Eaſe.

An Entablature that is ſupported by Angels, may be *Corinthian*, and the Virtues in *Ionick*, and both of them not ſo maſſive as is ordinary.

CASCABEL is, the Hindermoſt round Knob, or the utmoſt Part of the Breech of a Piece of Ordnance.

CASCADE [*Caſcata*, *Ital.*] ſignifies a Fall of Water, whether natural or artificial.

CASCAN [in *Fortification*] is a certain Hole or hollow Place, in Form of a Well, from whence a Gallery dug in like manner, under Ground, is conveyed, to give Air to the Enemy's Mine. Some of theſe *Caſcans* are more hollow than others, being uſually made in the Retrenchment of the Platform, near the Wall.

CASEMATE [in *Fortification*] ſometimes, is the Well, with its ſeveral ſubterraneous Branches or Paſſages, dug in the Paſſage of the Baſtion, till the Miner is heard at Work, and Air given to the Mine.

Alſo a certain Vault made of Maſon's Work, in that Part of the Flank of a Baſtion which is next the Curtain, on purpoſe to fire upon the Enemy, and to defend the Face of the oppoſite Baſtion of the Moat.

Sometimes it conſiſts of three Platforms, one above another, the Terreplane of the Baſtion being the higheſt. Behind the Parapet, which fronts along the Line of the Flank, there are Guns placed, laden with Cartridges of ſmall Shot, to ſcour along the Ditch; and theſe are covered from the Enemy's Batteries, by Earth-works, faced or lined with Wall, and are called, *Orillons*, or *Epaulments*: This is the beſt Defence a Place can have.

CASERN [in *Fortification*] is a little Room, or Lodgment, or Building, erected between the Rampart and the Houſes of fortified Towns, to ſerve as Apartments or Lodgings for the Soldiers of the Garriſon, to eaſe the Garriſon: There are uſually 2 Beds in each *Caſern* for ſix Soldiers to lie 3 and 3; but the 3d Part being always on the Guard, there are but four left in the *Caſern*, two in a Bed.

CASE-SHOT is, when Musket-Bullets, Stones, old Pieces of Iron, *&c.* are put up into Caſes, and ſo ſhot out of great Guns. 'Tis chiefly uſed at Sea, to clear the Enemy's Decks when they are full of Men.

CASK is alſo uſed as a common Name for Veſſels of divers Kinds, in Contradiſtinction from the Liquor, or other Matter, contained therein. Thus a Hogſhead of Spirits, *&c.* is ſaid to weigh 4 Hundred, 2 Quarters, and 22 ℔, Cask and Liquor: A Puncheon, 6 Hundred, 1 Quarter, and 2 ℔, Cask and Liquor.

A CASK *of Sugar* is, a Barrel of that Commodity containing from 8 to 11 Hundred Weight. A *Cask* of Almonds is about 3 Hundred Weight.

CASKETS [in a *Ship*] are ſmall Strings made of Sinnet, and faſtened to the Upper-part of the Yards in little Rings (which they call *Grommets*). Their Uſe is to faſten the Sail to its Yard when 'tis to be furl'd up. The biggeſt and longeſt of theſe is in the Middle of the Yard, juſt between the *Tyes*, and is called the *Breaſt Casket.*

CASSATION [in the *Civil Law*] the Abrogation, or annulling any Act or Procedure.

CASSIOPEIA [in *Aſtronomy*] one of the Conſtellations of the Northern Hemiſphere. See *Conſtellation.*

In 1572, there appeared a new Star in this Conſtellation, which at firſt ſurpaſſed, in Magnitude and Brightneſs, *Jupiter* himſelf; but it diminiſhed by Degrees, and at laſt diſappeared at the End of 18 Months. It alarm'd all the Aſtronomers of that Age, many of whom wrote Diſſertations on it: Amongſt the reſt, *Tycho Brahe*, *Kepler*, *Maurolycus*, *Licetus*, *Gramineus*, &c. *Beza* the Landgrave of *Heſſe*, *Broſa*, &c. wrote to prove it the ſame Star which appear'd to the *Magi* at the Birth of *Jeſus Chriſt*, and that it came to declare his ſecond Coming. They were anſwered by *Tycho.*

The Stars in the Conſtellation *Caſſiopeia*, in *Ptolemy*'s Catalogue, are 13; in *Tycho*'s, 28; in the *Britannick* Catalogue, Mr. *Flamſtead* makes them 56.

To CAST *a Point of Traverſe* [in *Navigation*] ſignifies, to prick down, on a *Chart*, the Point of the Compaſs any Land bears from you, or to find on what Point the Ship bears at any Inſtant, or what Way the Ship has made.

CASTOR, a fix'd Star of the ſecond Magnitude in *Gemini*, whoſe *Longitude is* 105°. 41′. *Latitude* 10°. 2′.

CASTOR *and Pollux*, are two *Meteors* which ſometimes, in a great Storm at Sea, appear ſticking to ſome Part of the Ship, in the Shape of Balls of Fire. Sometimes one is ſeen, and then 'tis called *Helena*; both of them are, by ſome, called *Tyndarides.*

CASTOR *and Pollux*, a Conſtellation of the fix'd Stars, the ſame with *Gemini*, being one of the 12 Signs of the *Zodiac.*

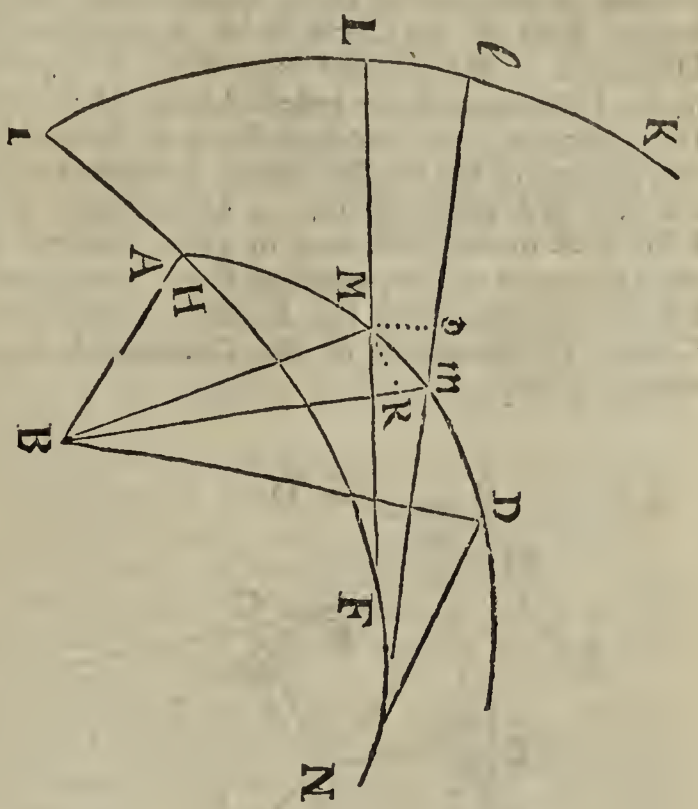
CASU *Conſimili* is a Writ of Entry, granted where the Tenant by Courteſy, or Tenant by Term of Life, or for the Life of another, doth alien in Fee, or in Tail, or for the Term of another's Life. *L.*

CASU *Proviſo* is a Writ of Entry given by the Statute of *Glouceſter*, in Caſe where a Tenant in Dower alieneth in Fee, or for Term of Life, or in Tail, and lieth for him, in Reverſion, againſt the Alienance. *L.*

CATABIBAZON, the *Dragon's Tail*, is ſo call'd becauſe it goes exactly againſt the *Dragon's Head.*

CATACATHARTICKS [of Κάτω downwards, and Καθαρτικὰ of Καθαίρω, *Gr.* to purge] are Medicines that purge downwards.

CATACAUSTICKS [of Κατὰ and Καυϛικὰ, of Καίω, *Gr.* to burn] or *Cauſticks by Reflection.*



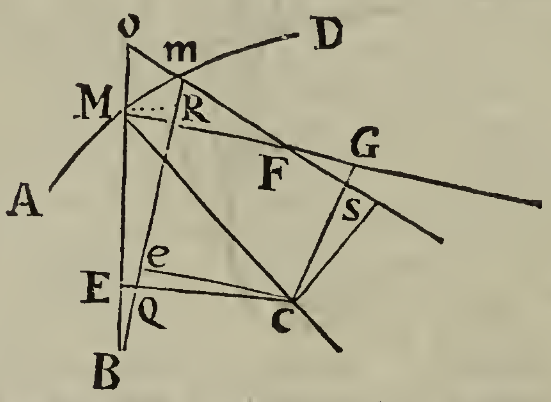
Suppoſe an infinite Number of Rays, as, B A, B M, B D, proceeding from the radiating Point B, and reflected at the Curve A M D, ſo that the Angles of Incidence be ſtill equal to thoſe of Reflection; the Curve H F N, to which the reflected Rays are Tangents continually (or which continually touches the Productions of them, A H, M F, D N) is called, the *Cauſtick by Reflection:* Or, it will amount to the ſame thing, if one ſays, that the *Cauſtick Curve* is that which is formed by joining the Points of Concourſe of the ſeveral reflected Rays. Let the reflected Ray H A be produced to I, and take $AI = AB$, and ſuppoſe the Curve I L K deſcribed by the Evolution (ſee the Word *Evolution*) of the *Cauſtick* H F N, beginning at the Point I. Again, ſuppoſing the incident and reflected Rays B M, m F, infinitely near to the incident and reflected B M, M F; and drawing out F M to l, on the Centres F, B, let the little Arches M O, M R be deſcribed. Theſe things premiſed, it is evident.

1. That the little Triangle M O m, M R m are always ſimilar and equal. For the Angles at O and R are Right ones; and the Angle R m M, F m D are equal, from the Suppoſition of the Angles of Incidence and Reflection, and $FmD = OmM$, as being vertically oppoſite; and the Hypothenuſe M m is alſo common to both Triangles; therefore they are ſimilar and equal, and O m always $= Rm$.

2. 'Tis clear that O m is the Increment of L M, and R m the Increment of B M, and theſe Increments are perpetually equal to one another. Therefore their reſpective Sums are ſo too; but the Sum of all O m (for the Portion A M of the reflecting Curve A M D) is $ML - IA$, and the Sum of all R m (for the ſame Portion of the Curve A M) is $BM - BA$, which are therefore equal to one another.

3. From the Nature of *Evolution*, the Tangent of the *Cauſtick*, F L is = the Portion of the Curve F H + the Right-Line H I, that is $FM + ML = AH + HF + IA$, and $ML - IA = AH +$

HF—MF; but ML—IA=BM—BA, and therefore the Portion of the *Cauſtick* HF=BM—BA+MF—AH perpetually. That is, the Portion of the *Cauſtick* HF, form'd from the reflected Rays of the Curve AM, is equal to the Difference of the incident Rays BM, BA, added to the Difference of the reflected Rays MF, AH. Or, taking any two incident Rays, as BA, BM, that Portion of the *Cauſtick* which is evolved while the Ray BA approached to a Coincidence with BM, is = to the Difference of theſe Incidents + the Difference of their reflected Rays. Now knowing how to determine the *Evoluta* of any given Curve, the Invention of the *Catacauſtick*, from thence, is eaſy.



Let the Point C be at the *Evoluta* of the reflecting Curve AMD; or, which is all one, let MC be the Radius of the Concavity for the Point M: And ſuppoſing the Arch Mm infinitely ſmall, let Bm, Cm, Fm be drawn. Farther, upon the Centers B, F, let the little Arch MR, MO, be deſcribed; and from the Point C, the Perpendiculars CE, Ce, CG, Cg, to the incident and reflected Rays. The Triangles MRm, MOm are ſimilar and equal, as was ſhewn before, and MR=MO. Alſo the Triangles CEM and CGM are ſimilar and equal, and ſo are Cem and Cgm; for the Angles at Ee, Gg, are right, and MC, mC, are common, and EMC=GMC, and emC=gmC (becauſe MC, mC, are Normals to the Curve, by Suppoſition of the *Evoluta*, and the Angles of Incidence and Reflection are equal) therefore CE=GC, and Ce=gC, and conſequently CE—Ce=CG—Cg, that is, EQ=SG. Laſtly, the Triangles BMR, and BEQ, are ſimilar, and ſo are FMO, FGS. Now let BM=y, ME=MG=a; therefore BM+BE=$2y-a$; let RM=OM=x, and FM=z, wherefore FG=$a-z$, and let it be required to find z, which determines the Point F in the *Cauſtick*. Then EQ=$\frac{y\dot{x}-a\dot{x}}{y}$, and EQ+MR=$\frac{2y\dot{x}-a\dot{x}}{y}$, alſo SG=$\frac{a\dot{x}-z\dot{x}}{z}$, and SG+MO=$\frac{a\dot{x}}{z}$: But by what was ſhewn before RM=MO, and SG=QE; therefore EQ+RM=SG+MO, *viz.* $\frac{2y\dot{x}-a\dot{x}}{y}=\frac{a\dot{x}}{z}$, and $2yz-za=ya$, and z (=MF)=$\frac{ay}{2y-a}$ *Q. E. I.*

Corol. 1. If the incident Rays are parallel, then $z=\frac{1}{2}a$. For y in this Caſe is infinite, and therefore $2y-a=2y$, the Quantity a vaniſhing if compared with y.

Corol. 2. If the incident Ray BM touches the Curve AMD in M, then a (=ME) is=o; and therefore z (=MF=O) alſo; from whence it follows, that the given Curve AMD, and the *Cauſtick* touch one another at the Point M.

Corol. 3. If the *Radius* of Concavity MC be=o, then again $a=o$, and $z=o$; from whence it follows, that the Curve AMD, and the *Cauſtick*, do cut one another at the Point M, and make an Angle equal to the Angle of Incidence.

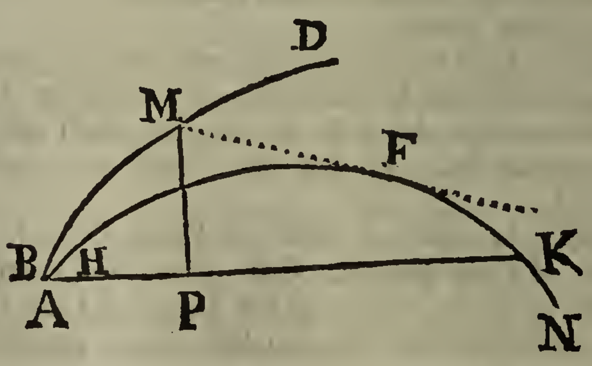
Corol. 4. If CM be infinite, then a (=ME) is infinite likewiſe, and z (=MF) =$-y$; and in this Caſe of the infinite Diſtance of the Point C, the Arch Mm becomes a Right-Line.

Corol. 5. 'Tis eaſy to apply all this that has been ſaid, when the Curve AMD is convex to the Radiating Point B (in which Caſe we ſhall have $z=\frac{ay}{2y+a}$) and to ſhew when the reflected Rays will come converging or diverging.

Corol. 6. When the Curve AMD is a Geometrick Curve, the *Cauſtick* will be ſo too; for if AMD be a Geometrick Curve, the *Evoluta* will be ſo too; that is, all the Points C may be Geometrically determined, and from the *Evoluta*, the Point F of the *Cauſtick* may be Geometrically determined alſo: But farther, the *Cauſtick*, upon this Suppoſition, ſhall always be rectifiable too, for Right-Lines may always be found equal to any Portions of it.

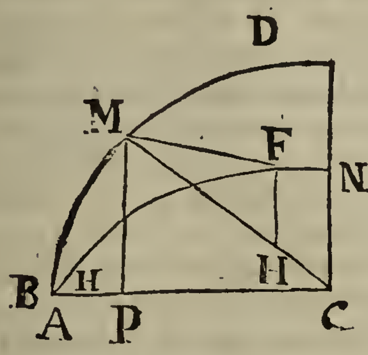
Corol. 7. 'Tis plain, that giving any 2 of the 3 Points, B, C, F; that is, the *Radiating Point*, the *Point of the Evoluta*, and the *Point of the Cauſtick*, the 3d Point may be determined.

By this general *Theorem* and its *Corollaries*, the *Cauſticks* of particular Curves are eaſily determined, however the Rays go, Converging, Diverging, or Parallel; but we will ſuppoſe the ſimpler Caſe of parallel Rays. Thus in the common *Parabola*, if the incident Rays are parallel, and cut the Axis at Right-angles, that is, are co-incident with the Ordinates to that Axis, then we have $z=\frac{1}{2}a$; ſo that taking in each reflected Ray the Length of $\frac{1}{2}a$, (a being the reflected Ray intercepted between the Point of Incidence, and the Point where the *Normal* from the *Evoluta* meets that reflected Ray) by this Means the ſeveral Points of the *Cauſtick* will be determined. The Length of the *Cauſtick* Curve alſo taken from the Vertex of the *Parabola* (where it begins) to any other Point, is equal to the Sum of the incident and reflected Rays.



As ſuppoſe AMD were the *Parabola*, whoſe Vertex A, and Axis AK, and AHF were the *Cauſtick*, beginning at the ſame Point: Now, becauſe the incident and reflected Rays at the Vertex are equal to nothing; that is, AB=o, and AH=o, therefore the Curve AHF (=PM—BA+MF—AH, by what was ſhewn before)=PM+MF.

In



In the Circle, the Rays P M being (as before) parallel to each other, and *Normal* to the Diameter A C, we have alſo $z=\frac{1}{2}a$. But ſince the *Evoluta* of the Circle is contracted into the Centre, the Radius M C being biſected in H, a Perpendicular H F to the reflected Ray M F gives the Point F in the *Cauſtick*. The reflected M F is alſo equal to $\frac{1}{2}$ the Incident B M perpetually; for M C being $=r$, and $MP=y$, we have from the ſimilar Triangles, M P C, M F H, $r:y::\frac{r}{2}:z\frac{y}{2}$. From hence 'tis clear, that the *Cauſtick* terminates at the Point K, biſecting the Radius C B at Right-Angles to A C. Again, the Portion of the *Cauſtick* A F $=3$ M F, becauſe $AF=PM+MF=y+z=y+\frac{1}{2}y$. But theſe Hints of Examples may ſuffice, without deſcending to thoſe of other Curves, which are to be done after the ſame manner from the general *Theorems* that theſe were, and the Conſtructions likewiſe to be deduced. 'Twould be no difficult Matter to ſhew alſo what Curves theſe *Cauſticks* are in every Example: As in the laſt Caſe of the Circle, that the *Cauſtick* is a Cycloid formed by the Revolution of the Circle deſcribed upon the Diameter H M, along the Quadrant deſcribed with the Radius C H. That the *Cauſtick* of the vulgar Semi-cycloid, when the Rays are parallel to the Axis of it, is alſo a vulgar Cycloid, deſcribed by the Revolution of a Circle upon the ſame Baſe. That the *Cauſtick* of a Logarithm Spiral, is the ſame Curve, but only ſet in a different Poſition; and the like others.

CATACHRESIS [Καταχρῆσις of Καταχράωμαι, *Gr.* to abuſe] is a Trope in Rhetorick, by which Liberty is given to borrow the Name of a Thing, tho' quite contrary to what it ſhould be, becauſe it cannot be otherways expreſſed; as when we ſay, *A Silver Ink-horn:* Here Reaſon demurs at the Expreſſion; yet Neceſſity obliges us to make Uſe of it. But perhaps *Ink-horn* is corrupted from *Inkern* or *Inker*.

CATACLIDA is, the Rib called the *Subclavian*.

CATACOUSTICKS, or *Cataphonicks*, [of Κατὰ and ἀκουστικὰ of Ἀκούω, *Gr.* to hear] is the Science of Reflected Sounds, or which teaches the Doctrine and Properties of *Echoes*.

CATADIOPTRICAL *Teleſcope*, or *Reflecting Teleſcope*. See *Teleſcope*.

CATAGMA [Κάταγμα, *Gr.* a Fracture] is a breaking of Bones, or a Separation of the *Continuum* in the hard Parts of the Body, which is affected with ſome hard Inſtrument forcibly impreſſed upon the Part; whoſe Differences are taken from the Form, the Part, and ſeveral Accidents. *Blanchard.*

CATAGMATICK *Medicines*, are ſuch as are uſed to help to conſolidate broken Bones.

CATALEPSIS, or *Catochus*, is a Diſeaſe almoſt like an Apoplexy, being an Abolition of all the Animal Functions; except that the Reſpiration remains entire; and the Patient preſerves the ſame Habit of Body that he had before he fell ſick. *Blanchard.*

CATALECTICKS [in *Poetry*] as, *Catalectick Verſes*, were ſuch as wanted either Feet or Syllables.

CATALLIS *Captis Nomine Diſtrictionis*, is a Writ that lieth within a Borough, or within a Houſe, for Rent going out of the ſame, and warranteth a Man to take the Doors, Windows, or Grates for Rent. *L.*

CATALLIS *Reddendis* is, a Writ which lieth where Goods being delivered by any Man to keep unto a certain Day, and be not upon Demand delivered at a Day; and is otherwiſe called, *A Writ of Detinue. L.*

CATAPASMA [of Καταπάσσειν, *Gr.* to water] a fragrant Powder which is ſometimes applied to the *Scrobiculum Cordis*, to ſtrengthen the Stomach.

CATAPHORA is the ſame with *Coma*; they only differ in this, that *Cataphora* is taken as the Genus to all Sorts of Stupors that are not attended with a Fever. *Blanchard.*

CATAPLASM is a topical Medicine of the Conſiſtence of a Pultiſe; it is uſually deſcribed two Ways, either boiled, or without it; the former is more frequent, the latter of more Efficacy: In the former, they are to take ſuch Vegetables as are proper, as Roots, Herbs, Seeds, Flowers, Fruits, *&c.* adding proper Meals, or omitting them: All which are boiled up in a convenient Quantity of Liquor, *v. g.* Water, Beer, Milk, Honey, *&c.* to the Conſiſtence of a Pultiſe: The latter is prepareed commonly of Vegetables, ſhred ſmall with the Infuſion of ſo much Liquor only as may make it of the former Conſiſtence. You may add here Meal, Crums of Bread, Oils, Ointments, as in the former Sort of *Cataplaſms*. *Blanchard.*

CATAPTOSIS is one Symptom of an Epilepſy, when Men fall ſuddenly to the Ground. *Blanchard.*

CATARACT, a Diſeaſe in the Eyes, and is two-fold, either beginning, as a *Suffuſion* only, or confirmed, as a *Cataract*, properly ſo call'd; the *Incipient* is but a Suffuſion of the Eye, when little Clouds, Motes, and Flies, ſeem to fly before the Eyes: but the confirmed *Cataract* is, when the Pupil of the Eye is either wholly, or in Part, covered and ſhut up with a little thin Skin; ſo that the Sun-Beams have not due Admittance to the Eye. *Blanchard.*

CATARACT is a Precipice in the Channel of a River, cauſed by Rocks, or other Obſtacle ſtopping the Courſe of its Stream, from whence the Water falls with a great Noiſe and Impetuoſity, as the *Cataracts* of *Nile*, *Danube*, *Rhine*, &c.

CATARRH [Κατάῤῥους of Καταῤῥέω, *Gr.* to flow down] is a Defluxion of Humours from the Head towards the Parts under it, as the Noſtrils, Mouth, Lungs, *&c.* Some diſtinguiſh it by the Name of *Coryza*, when it falls on the Noſtrils; by that of *Bronchus*, when on the Jaws; and by the Word *Rheum*, when it falls on the Breaſt.

CATARRH *of the Spinal Marrow* [in *Medicine*] a falling out of the Marrow of the Back-Bone, which happens when certain lymphatick Veſſels are broken.

CATARRHUS *Suffocatorius* [in *Medicine*] a ſuffocating Rheum ſeated in the *Larynx* and *Epiglottis*, which conſtringes ſo that the Glandules about the Throat are ſwelled, whereupon a Difficulty of breathing enſues, and Danger of being ſuffocated. *L.*

CATASARCA [Κατασάρκα, *Gr.*] a kind of Dropſy, the ſame as *Anaſarca*.

CATASTASIS [Κατάστασις, *Gr.*] is applied, by *Galen*, to the Seaſons of the Year, the Diſpoſition of the Body, or of Time; but, according to *Hippocrates*, is the Conſtitution or State of any thing, or, the ſame as *Catataſis*.

CATATASIS [of Κατατεινω, *Gr.* to ſtretch out] an Extenſion, or ſtretching out of an Animal Body towards the lower Parts.

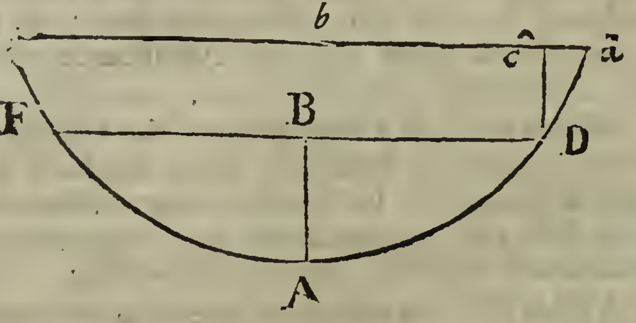
CATATYPOSIS [Κατατύπωσις, *Gr.*] a Figure in Rhetorick, when one thing is done by the Example of another.

CATCHES, are thoſe Parts of a Clock that hold by hooking and catching hold of.

CATEGORIA [Κατηγορία, and CATEGOREMA, Κατηγόρημα, of Κατηγορεύω, *Gr.* to accuſe] the ſame with *Prædicamentum* in Logick. See *Prædicamentum*.

CATENARIA is, the Curve Line which a Rope hanging freely between two Points of Suſpenſion, forms itſelf into. What the Nature of this Curve is, was enquired amongſt the Geometers in *Galileo*'s Time, but I don't find any thing was done towards a Diſcovery, till in the Year 1690, *James Bernouli* publiſhed it as a Problem; which, about 2 Months after, *Leibnitz* declared he had found out, and would communicate within the Year. In *December* 1690, *John* the Brother of *James Bernouli*, communicated an Inveſtigation of it to the Editors of the *Acta Eruditorum*, which was publiſh'd afterwards, *June* 1691. This *Catenary*, or *Funicular*, he ſaith, he found not to be truly *Geometrical*, but of the *Mechanical Kind*, becauſe its Nature cannot be expreſſed by a determinate Algebraick Equation; but *Leibnitz* gives its Conſtruction Geometrically. In the Year 1697, the Month of *Auguſt*, Dr. *Gregory* publiſhed a Method of Inveſtigation of the former, and ſome other new Properties of this Curve, which you will find there, from whence this Method of finding the general Property of the *Catenaria* is taken.

1. Suppoſe a Line heavy and flexible, the two Extremes of which, F and D, are firmly fixed in thoſe Points; by its Weight it is bent into a certain Curve, F A D, which is call'd the *Catenaria*.



2. Let B D and *b d* be parallel to the Horizon, A B perpendicular to B D, and D δ parallel to A B, and the Points B *b* infinitely near to each other. From the Laws of Mechanicks, any three Powers in Æquilibrio are, to one another, as the Lines parallel to the Lines of their Direction, (or inclined in any given Angle) and terminated by their mutual Concourſes: Hence if D *d* expreſſes the abſolute Gravity of the Particle D *d* (as it will, if we allow the Chain to be every Way uniform) then D δ will expreſs that Part of the Gravity that acts perpendicularly upon D *d*, and by the Means of which this Particle endeavours to reduce itſelf to a Vertical Poſition; ſo that if this Lineola *d* δ be conſtant, the perpendicular Action of Gravity upon the Parts of the Chain will be conſtant too, and may therefore be expreſſed by any given Right Line *a*. Farther, the Lineola D δ will expreſs the Force which acts againſt that *Conatus* of the Particle D *d*, by which it endeavours to reſtore itſelf into a Poſition perpendicular to the Horizon) and hinders it from doing ſo: This Force proceeds from the ponderous Line D A drawing according to the Direction D *d*, and is (*cæteris paribus*) proportional to the Line D A, which is the Cauſe of it. Suppoſing the Curve F A D therefore, as before, whoſe Vertex (the loweſt Point of the *Catena*) is A, Axis A B, Ordinate B D, Fluxion of the Axis D δ = B *b*, Fluxion of the Ordinate *d* δ, the Relation of theſe two Fluxions is thus: *viz.* *d* δ : D d : : *a* : D A Curve; which is the fundamental Property of the Curve, and may be thus expreſſed (putting A B = *x*, and B D = *y*, and A D = *c*) $\dot{y} = \frac{a\dot{x}}{c}$.

CATHARPINGS, are ſmall Ropes in a Ship running in little Blocks, from one Side of the Shrouds to the other, near the Deck, they belong only to the Main-ſhrouds and Fore-ſhrouds. Their Uſe is, to force the Shrouds tight, for the Eaſe and Safety of the Maſts when the Ship rolls; they are alſo at the ſetting on of the Puttocks of the Shrouds, but there they do not run in Blocks, but are made faſt.

CATHARTICK [Καθαρτικός, of καθαίρω, *Gr.*] is a purging Medicine, which cleanſes the Stomach, the Guts, and whatſoever is vitious and heterogeneous in the Blood, and throws it into the Common-ſhore of the Guts. *Blanchard.* See *Purgatio* & *Vomitorium*.

CATHEMERINA *Febris*, the ſame with a *Quotidian*.

CATHERETICK *Medicines*, are ſuch as conſume and carry off Carnoſities, proud Fleſh, and Excreſcences, ariſing in Wounds, &c.

CATHETER [Καθετὴρ, *Gr.*] is a fiſtulous Inſtrument, which is thruſt up the Yard into the Bladder, to provoke Urine when 'tis ſuppreſſed by the Stone; or into whoſe Cavity an Inſtrument, called *Itinerarium*, is thruſt to find out the Stone in the Bladder, that then the *Sphincter* of the Bladder may be ſhown, and an Inciſion be made in the *Perinæum*.

CATHETERISMUS is, the Adminiſtration or Operation of injecting any thing into the Bladder, by a Catheter, or a Syringe.

CATHETI in a Right-angled Triangle, are the Sides including the Right-Angle. If it be in the ſingular Number, *Cathetus*.

CATHETUS [Κάθετος, *Gr.*] ſignifies the Perpendicular only, the other Leg being called the *Baſe*. Alſo *Cathetus*, [in *Catoptricks*] ſignifies a Line drawn from the Point of Reflection perpendicular to the Plane of the Glaſs.

CATHETUS [in *Architecture*] is taken for a Line ſuppoſed directly to tranſverſe the Middle of a cylindrical Body, as of a Balliſter or Column. In the *Ionick* Chapiter it is alſo a Line falling perpendicularly, and paſſing thro' the Centre or Eye of the *Voluta*.

CATHETUS *of Incidence*, is a Right-line drawn from a Point of the Object, perpendicular to the Reflecting Line.

CATHETUS *of Reflection*, or *Cathetus of the Eye*, is a Right-line drawn from the Perpendicular to the Reflecting Line.

CATHOLICON, an Univerſal Remedy, good againſt all Diſtempers.

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CATHETUS *of Incidence*, is, a Right-line drawn from a Point of the Object, perpendicular to the Reflecting-line.

CATHETUS *of Reflection*, or *Cathetus of the Eye*, is a Right-line drawn from the Eye, perpendicular to the Reflecting-line.

CATHETUS *of Obligation*, is a Right-line drawn perpendicular to the *Speculum* in the Point of *Incidence* or *Reflexion*.

CATHOLICON [Καθολικὸν, *Gr.*] an univerſal Remedy, good againſt all Diſtempers.

CATHYPNIA [Καθυπνόω, *Gr.* to ſleep ſound] a deep or profound Sleep, ſuch as Men are in by taking Opiates, or by Lethargy, *&c.*

CATKINS [in *Botany*] a kind of Subſtance that grows on Nut-trees, Pine-trees, Birch-trees, *&c.* in Winter-time, which fall off when the Trees begin to put forth their Leaves.

CATLING [with *Surgeons*] a ſort of a diſmembring Knife, uſed in the cutting off any corrupted Member, or any Part of the Body.

CATLINGS [in *Botany*] the Down, or Moſs, growing on Walnut-trees.

CATO-CATHARTICK [of Κάτω downwards, and Καθαρτικὰ, *Gr.*] *Medicines*, are ſuch as work downwards, and purge by Stool only: Theſe are alſo called *Catoreticks*.

CATOCHE, the ſame with *Catalepſis*.

CATOPSIS [Κατοψις, *Gr.*] the ſame with *Myopia*.

CATOPTRICK *Ciſtula*, a Machine, or Apparatus, whereby little Bodies are repreſented extremly large, and near ones, extremely wide, and diffuſed through a vaſt Space, and other agreeable Phænomena, by means of Mirrours diſpoſed by the Laws of *Catoptricks*, in the Concavity of a kind of Cheſt.

CATOPTRICKS [Κατοπτρικὴ of Κατόπτωμαι, *Gr.*] is that Part of the Science of *Opticks* which treats of *Reflex-viſion*, and explains the Laws and Properties of *Reflexion*.

CATOPTRICAL *Dial*, one that exhibits Objects by reflected Rays.

CATOPTRICAL *Teleſcope*, one that exhibits Objects by Reflection.

CATORETICKS, the ſame with *Catharticks*.

CATT, or *Catt-Head*, [in a *Ship*] a large Piece of Wood ſo called; it is faſtened aloft, over the *Hawſe*, having at one End two Shivers, in which is reeved a Rope with a Block, and at the End of the Rope a large Hook, which is called the *Catt-Hook*: Its Uſe is, to triſe up the Anchor from the *Hawſe* to the Top of the *Fore-Caſtle*, where there is faſtened a Stopper (*i. e.* a Piece of Rope ſpliced into it) at the Anchor, which ſerves to hitch the Hook of his *Catt-Rope* into the Ring of the Anchor.

CATT-HOLES [in a *Ship*] are Holes in her Stern above the Gun-Room Port, and thro' them, by Means of a *Stern-faſt* (that is, ſome Faſtenings behind the Stern) to which a *Cable* or *Hawſer* is brought, a Ship (upon Occaſion) is heaved a-Stern.

CATULOTICA [of Κατουλόω, *Gr.* to skin over] Medicines that cicatrize Wounds.

CAVALIER [in *Fortification*] is a Heap or Maſs of Earth raiſed in a Fortreſs, to lodge the Cannon for ſecuring the Field, or oppoſing a commanding Work. Theſe *Cavaliers* are ſometimes of a round, ſometimes of a ſquare Figure, the Top being bordered with a Parapet to cover the Cannon therein mounted. There muſt be twelve Foot between Cannon and Cannon; and if they are raiſed on the Incloſure of any Place, whether in the Middle of the Curtin, or in the Gorge or Baſtion, are generally 15 or 18 Foot high above the Terre-plane of the Rampart.

A *Cavalier* is ſometimes called a *Double Baſtion*, and is deſigned to overlook the Enemy's Batteries, and to ſcour their Trenches.

CAVA-VENA, the greateſt Vein in the Body, which deſcends from the Heart, ſo called from its great Cavity; and into it, as into a common Channel, do all the leſſer Veſſels, except the *Pulmonaris*, empty themſelves. Its Root may very properly be ſaid to be in the Liver; for by its Capillaries it receives the Blood that is tranſcolated through the glandulous *Parenchyma* of the Liver, from the Capillaries of the *Porta*, and by its aſcending Trunk, conveys it to the Heart. Theſe Capillaries emptying all the Blood exhauſted out of the Liver into the *Cava*, it is preſently divided into the *Aſcending* and *Deſcending Trunk*. The *Aſcending* enters the *Diaphragm*, and goes to the *Thorax*. The *Deſcending Trunk* is ſomewhat narrower than the *Aſcending*, and paſſes down along with the great Artery, continuing undivided to the fourth *Vertebra* of the Loins; but, in the mean time, ſends forth divers Branches from its Trunk, as, the *Venæ Adipoſæ*, *Emulgents*, *Spermaticks*, *Lumbares*: All theſe Veins being ſent forth of the Trunk, by the time it is come to the fourth *Vertebra* of the Loins, where it turns to behind the *Arteria Magna*, above or before which it had thus deſcended, and is then divided into equal Branches, called *Iliaci*, becauſe they paſs over the *Os Ilion*, *&c.* as they go down to the Thighs.

This Vein carries nothing to the Liver, but receives the Blood from thence, carrying it, and what it receives from its other Branches, into the Right Ventricle of the Heart, that it may be there anew improved and inſpirited.

CAUDA *Lucida*, the *Lion's Tail*, a fixed Star of the firſt Magnitude, whoſe *Longitude* is 167°, 53′; *Latitude* 12°, 16′; *Right Aſcenſion* 173°, 9′.

CAUDA *Draconis* [in *Aſtronomy*] the *Dragon's Tail*, the Name of the Moon's deſcending Node.

CAVEAT [in *Law*] a Bill entered in the Eccleſiaſtical Court, to ſtop the Proceedings of one who would prove a Will to the Prejudice of another.

CAVERNOSA *Corpora* [in *Anatomy*] are two cavernous Bodies, of an indeterminate Length and Thickneſs, of which the *Penis* is principally compoſed; the ſame that are called *Corpora Nervoſa*, and *Spongioſa*.

CAVERNOSA *Corpora Clitoris* [in *Anatomy*] are two nervous or ſpongy Bodies, like thoſe of the *Penis*, having their Origin from the lower Part of the *Os Pubis*, on each Side, and uniting together, conſtitute the Body of the *Clitoris*, as thoſe do that of the *Penis*.

CAVERNOSUM *Corpus Urethræ* [in *Anatomy*] a third ſpongious Body of the *Penis*, ſo called, becauſe the *Urethra*, or Urinary Paſſage of the *Penis* is incloſed by it.

CAVERNOSUM *Corpus*, of the *Pudendum*, the ſame as *Reticulare Corpus*.

CAVIN [in *Fortification*] is a hollow Place, proper to favour the Approaches to a Fortreſs, ſo that one may advance therein under the Covert towards the Enemy's, as it were in a Trench. If it be within Musket-ſhot, 'tis a Place of Arms ready made to hand; and a Convenience for opening the Trenches without Fear of the Enemy's Shot.

CAULEDON is the breaking of Bones acroſs, when the Parts of the Bones are ſo ſeparate that they will not lie direct.

CAULICOLI [in *Architecture*] are the little carved Scrolls which are under the *Abacus* in the *Corinthian* Capital.

CAULIFEROUS [of *Cauli* a Stalk, and *Fero*, *L.* to bear] *Herbs* or *Plants*, amongſt the Botaniſts, are ſuch as have a true *Caulis*, or Stalk, as a great many have not.

CAULIS [in *Botany*] is the Stalk of any Herb, or the Stem or Trunk of a Tree. *L.*

CAUSA *Matrimonii prælocuti*, is a Writ which lieth in Caſe where a Woman giveth Lands to a Man in Fee-ſimple, to the Intent he ſhall marry her, and refuſeth ſo to do in reaſonable time, being required thereunto by the Woman.

CAUSAL *Propoſitions* are thoſe that contain two Propoſitions joined together by a Conjunction of the Cauſe, (*becauſe*, or *to the End that*) as, *Woe to the Rich, becauſe they have their Felicity in this World. The Wicked are advanced, to the End, that falling from on high, their Fall may be the greater.*

CAUSALTY is, the Action or Power of a Cauſe in producing its Effect.

CAUSALTY is the Tin-miner's Word for the Earth, a ſtony Matter, which is, by waſhing in the Stamping-Mills, *&c.* ſeparated from the Tin-Ore, before it is dried and goes to the Crazing-Mill.

CAUSAM *nobis ſignifices*, is a Writ which lieth to the Mayor of the Town, or City, *&c.* that formerly, by the King's Writ, being commanded to give Seiſin unto the King's Grantee of any Lands or Tenements, doth delay ſo to do, willing him to ſhew Cauſe why he ſo delayeth the Performance of his Charge.

CAUSODES, the ſame with *Cauſus*: Which ſee.

CAUSTICK *Curves* is, when an infinite Number of Rays, B A, B M, B D, Fig. 1, 2. iſſuing from a luminous Point B, are reflected by the Curve A M D in ſuch Manner, that the Angles of Reflexion are equal to the Angles of Incidence: The Line H F N, that touches the reflected Rays, or their Continuations, A H, M F, D N, is called a *Cauſtick by Reflection.*

COROL. I.

Fig. 1. If H A be continued out to I, ſo that $AI = AB$, and the Cauſtick H F N, be taken as an Evolute, and I A as the firſt Radius of Evolution, then will the Involute I L K to the ſame, be of ſuch a Nature, that the Tangent F L ſhall be conſtantly equal to the Part F H of the Cauſtick Plus the Right-line H I; and if B m, m F, be ſuppoſed two Reflected Rays infinitely near BM, MF, and if F m be continued out to l, and the little Arches, M O, m R, be deſcribed from the Centres, F, B, the ſmall right-angled Triangles, M O m, M R m, will be equal and ſimilar, ſince the Angle $OmN = FmD = RmM$, and the Hypothenuſe M m is common, ſo that $Om = Rm$: Now, becauſe O m is the Fluxion of L m, and R m the Fluxion of B M; and this is always ſo, where-ever the Point M be taken: Therefore $ML - IA$, or $AH + HF - MF$, the Sum of all the Fluxions, O m in the Part A M of the Curve, is $= BM - BA$, the Sum of all the Fluxions R m in the ſame Part A M, and conſequently the Part H F of the Cauſtick H F N, will be equal to $BM - BA + MF - AH$.

There may happen ſeveral Caſes, according as the incident Ray B A is greater or leſs than B M, and the reflected Ray H A, as a Radius of Evolution, diſengages itſelf from the Part H F of the Curve, to become M F; but we can always prove, as we have already, that the Difference of the Radii of Incidence is equal to the Difference of the reflected Rays Plus the Part of the Cauſtick taken as an Evolute, that one of the Rays diſengages itſelf from, before it coincides with the other; for Example, $BM - BA = MF + FH - AH$; *per* Fig. 2; and conſequently, $FH = BM - BA + AH - MF$.

If the Arch A P be deſcribed from the Centre B, it is plain from Fig. 1, 2. that P M ſhall be the Difference of the incident Rays B M, B A; and if the luminous Point B becomes infinitely diſtant from the Curve A M D, *per* Fig. 3. the incident Rays B A, B M, will become parallel, and the Arch A P a ſtrait Line perpendicular to thoſe Rays.

COROL. II.

Fig. 1. If the Figure B A M D be ſuppoſed to be inverted on the ſame Plane, ſo that the Point B coincides with I, and the Tangent to the Curve A M D, in its firſt Situation, ſtill touches in this latter one; and if the Curve a M d revolves on A M D, *viz.* on itſelf, ſo that the Parts a M, A M, be always equal, I ſay, by this Motion the Point B will deſcribe a kind of Cycloid I L K, which will be an Involute to the Cauſtick H F N, taken as an Evolute:

For, from the Generation it follows: 1°. That the Line L M, drawn from the deſcribent Point L to the Point of Contact M, will be perpendicular to the Curve I L K. 2°. That LA or $IA = BA$, and $LM = BM$. 3°. That the Angle made by the Right-lines M L, B M, with the common Tangent in M, are equal; and therefore, if L M be continued out to F, M F ſhall be the incident Ray, B M reflected; whence the Perpendicular L F touches the Cauſtick H F N: And ſince this is ſo always, let the Point L be taken where it will, it is plain that I L K is the Involute to the Cauſtick H F N, the Right-line H I being the Radius of Evolution.

Hence it follows, that the Part F H or $FL - HI = BM + MF - BA - AH$, which is what has been otherwiſe demonſtrated in the Corollary aforegoing.

COROL. III.

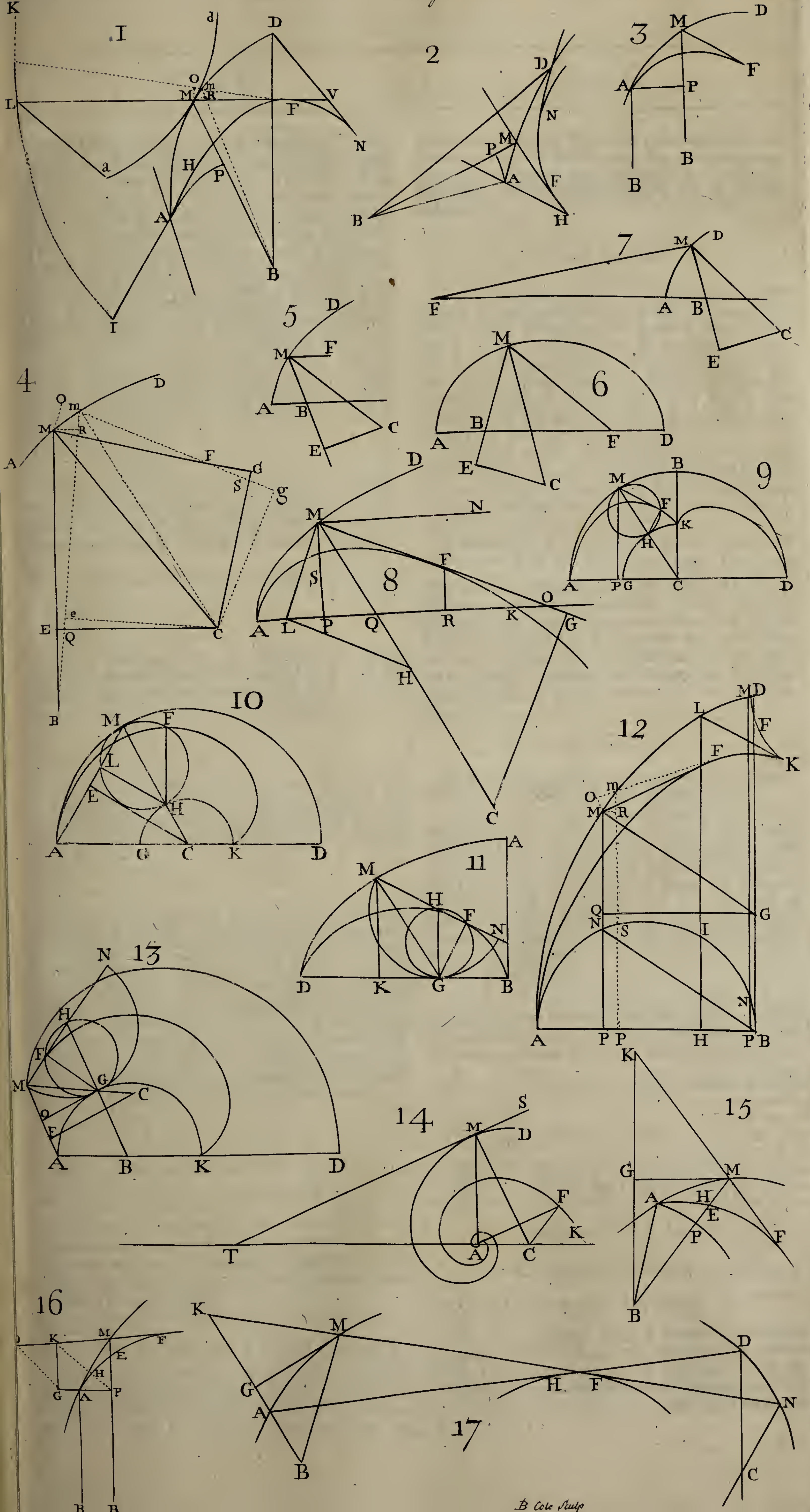
When the Tangent D N is infinitely near the Tangent F M, it is manifeſt that the Point of Contact N, and the Point V of Interſection, will both coincide with F the other Point of Contact; ſo that the Point F, wherein the reflected Ray M F touches the Cauſtick H F N, is determined, with only ſeeking the Concurrence of the infinitely near reflected Rays M F, m F; conſequently if we ſuppoſe an infinite Number of infinitely near incident Rays, the Interſections of theſe Rays reflected will form a Polygon of an infinite Number of Sides, *viz.* the Cauſtick H F N.

PROP. I.

Fig. 4. The Nature of the Curve A M D, the luminous Point B, and the incident Ray B M, being given, to find the Point F in the reflected Ray M F given in Poſition, wherein it touches the Cauſtick.

Find

Place this under the Article Caustick Curves



B Cole Sculp

Find MC, the Length of the Radius of Evolution in the Point M, aſſume the infinitely ſmall Arch Mm, draw the Right-lines Bm, Cm, Fm, from the Centres B, F, deſcribe the ſmall Arches MR, MO, draw CE, Ce, CG, Cg, perpendicular to the incident and reflected Rays; and laſtly, call the given Quantities BM, y; ME, or MG, a.

Now we prove (as in * *Corol.* I.) that the Triangles MRm, MOm, are equal and ſimilar; and ſo MR $=$ MO: But becauſe of the Equality of the Angles of Incidence and Reflexion, we have alſo CE $=$ CG, Ce $=$ Cg, and therefore CE $-$ Ce or EQ $=$ CG $-$ Cg or SG; whence, becauſe of the ſimilar Triangles BMR, BEQ, TMO, FGS, BM $+$ BE $(2y-a)$: BM (y) :: MR $+$ EQ or MO $+$ GS : MR or MO :: MG (a) : MF $=\frac{ay}{2a-y}$.

If the luminous Point B falls on the other Side the Point E, with reſpect to the Point M; or, (which is the ſame thing) if the Curve AMD be convex, next to the luminous Point B, then will y be negative, and conſequently MF $=\frac{-ay}{-2y-a}$ or $\frac{ay}{2y+a}$.

If y be infinite, that is, If the Point B be at an infinite Diſtance from the Curve AMD, then the incident Rays will be parallel, and MF will be $=\frac{1}{2}a$, becauſe a is nothing with reſpect to $2y$.

COROL. I.

Fig. 1, 2. Becauſe MF has but one Value, wherein is the Radius of Evolution; therefore the Curve AMD can have only one Cauſtick by Reflexion, HFN, ſince there is * but one Evolute to it.

COROL. II.

When the Involute AMD is a Geometrical Curve, it is manifeſt the Evolute is one likewiſe; that is, any Point C in it may be determined Geometrically, and conſequently any Point F in the Cauſtick thereof, may be determined Geometrically; or (which is the ſame) the Cauſtick HFN will be a Geometrical Curve; I ſay, moreover, that the Cauſtick is always rectifiable, becauſe, by Means of the Curve AMD, which is ſuppoſed to be a Geometrical one, it is manifeſt that ſtraight Lines may be found equal to any Part thereof.

COROL. III.

Fig. 4. If the Curve AMD be convex, next to the luminous Point B, the Value of ME $\left(\frac{ay}{2y+a}\right)$ will always be poſitive, and the Point F muſt of Conſequence be aſſumed on the ſame Side the Point M as the Point C, as we have ſuppoſed in the Inveſtigation aforegoing; therefore the infinitely near reflected Rays do diverge.

But if the Curve AMD be concave, next to the luminous Point B, MF $\left(\frac{ay}{2y-a}\right)$ will be poſitive, when y is greater than $\frac{1}{2}a$, negative when the ſame is leſs, and infinite when it is $=\frac{1}{2}a$; whence if a Circle be deſcribed with a Diameter equal to $\frac{1}{2}$ MC the Radius of Evolution, the infinitely near reflected Rays will converge, when the luminous Point B fall without the Circumference thereof, and diverge when the ſame falls within it; and finally, will be parallel when it falls in the Circumference.

COROL. IV.

If the incident Ray BM touches the Curve AMD in the Point M, then will ME $(a)=o$; and therefore MF $=o$: But becauſe the reflected Ray is then in the Direction of the incident Ray, and it is the Nature of the Cauſtick to touch all the reflected Rays, therefore it ſhall likewiſe the incident Ray BM in the Point M; that is, the Cauſtick and the given Curve will have the ſame Tangent in the common Point M.

If the Radius CM of Evolution be nothing, then ſtill will ME $(a)=o$, and conſequently MF $=o$; therefore the given Curve and the Cauſtick make an Angle with each other in the common Point M, equal to the Angle of Incidence.

If the Radius of Evolution CM be infinite, the ſmall Arch Mm will become a ſtraight Line, and MF $=\mp y$, becauſe ME (a) being infinite, y will be nothing with regard to a: Now ſince this Expreſſion or Value is negative when the Points B and C are both on the ſame Side the Line AMD, and poſitive when one is on one Side and the other on the other; therefore the infinitely near reflected Rays will always diverge when AMD is a Right-line.

COROL. V.

It is evident, that when any two of the Points, B, C, F, are given, the third is eaſily found.

Fig. 5. 1°. Let the involute Curve AMD be a Parabola, and the luminous Point B the Focus, then (from the *Conic* Elements) it is manifeſt, that all the reflected Rays will be parallel to the Axis; and ſo in every Poſition of the Point M, MF will be infinite, and conſequently $a=2y$; whence, if you aſſume ME $=2$ MB, and draw the Perpendicular EC, this will interſect the Perpendicular MC to the Curve AMD in the Point C, which will be in the Evolute.

Fig. 6. 2°. Let AMD be an Ellipſis, and the luminous Point B one of the Foci, then it is evident, that all the reflected Rays MF will coincide in the other Focus F; and if you call MF, z, then will $z=\frac{ay}{2y-a}$; from whence comes out ME $(a)=\frac{2yz}{y+z}$, which was ſought.

But if the Curve AMD Fig. 17. be an Hyperbola, the Focus F will fall the contrary Way, or without the Curve; and therefore MF (z) will become negative, and conſequently ME $(a)=\frac{-2yz}{y-z}$ or $\frac{2yz}{z-y}$, whence ariſes the following Conſtruction, which will ſerve for the Ellipſis alſo.

Fig. 6, 7. Aſſume ME a fourth Proportional to $\frac{1}{2}$ the tranſverſe Axis, and the incident and reflected Rays, and draw the Perpendicular EC, this ſhall interſect the Line MC perpendicular to the Curve in the Point C, which ſhall be in the Evolute.

Ex-

EXAMPLE I.

Fig. 8. Let A M D be a Parabola, and let the incident Rays P M fall perpendicular to the Axis, it is required to find the Point F in the reflected Rays M F, wherein they touch the Cauſtick A F K.

If we draw M C the Radius of Evolution, and the Line C G perpendicular to the reflected Ray M F, it is manifeſt that we muſt aſſume M F = $\frac{1}{2}$ M G: But this Conſtruction may be ſhortened, if you conſider, that when M N is drawn parallel to the Axis A P, and the Right-line M L to the Focus L, the Angles L M P, F M N, ſhall be equal, ſince from the Nature of the Parabola, L M Q = Q M N, and by the Suppoſition P M Q = Q M F, if then the common Angle P M F be added to both, the Angle L M F ſhall be equal to the Angle P M N, that is, a Right-angle: Now it has been demonſtrated, that L H perpendicular to M L ſhall interſect the Radius of Evolution M C in H the Middle thereof; therefore if M C be drawn equal and parallel to L H, it will be one of the reflected Rays, and will touch the Cauſtick A F K in the Point F, which was to be found.

If the reflected Ray M F be ſuppoſed parallel to the Axis A P, it is manifeſt that the Point F of the Cauſtick will be at the greateſt Diſtance poſſible from A P, becauſe the Tangent to that Point will be parallel to the Axis, and conſequently, in order to determine that Point in all the Cauſticks, as A F K, formed by incident Rays parallel to the Axis of the given Curve, we need only conſider that then M Q muſt be equal to P Q, and therefore $\dot{y} = \dot{x}$.

Now let $ax = yy$, then $\dot{y} = \frac{a\dot{x}}{2\sqrt{ax}} = \dot{x}$, and ſo a P $(x) = \frac{1}{4}a$: that is, when the Point P falls in the Focus L, the reflected Ray M F will be parallel to the Axis, which is a known Truth otherwiſe eſtabliſhed; ſince in this Caſe M P coinciding with L M, M F muſt alſo coincide with M N, and L H with I Q, whence M F will then be equal to M L; and therefore if F R be drawn perpendicular to the Axis A R, or A L + M E, will be $= \frac{3}{4}a$, we may obſerve, that in this Caſe the Part A F of the Cauſtick is equal to the Parameter, ſince it is always equal to P M + M F.

To determine the Point K, wherein the Cauſtick A F K interſects the Axis A P, the Value of M O muſt be found, and made equal to that of M F; for it is plain, when the Point F falls in K, the when the Point F coincides with K, it is manifeſt that the Lines M F, M O, will become equal to one another: Lines M F, M O, become equal to each other; for Therefore if the unknown Quantity M O be called t, from the Biſection of the Angle P M O by M Q, perpendicular to the Curve, we ſhall have M P (y) : M O (t) :: P Q $\left(\frac{y\dot{y}}{\dot{x}}\right)$: O Q $= \frac{t\dot{y}}{\dot{x}}$, and therefore O P $= \frac{t\dot{y} = y\dot{y}}{\dot{x}} = \sqrt{tt - yy}$, becauſe of the Right-angled Triangle M P O, and dividing both Sides by $t + y$, there comes out $\frac{\dot{y}}{\dot{x}} = \sqrt{\frac{t-y}{t+y}}$ from whence we get M O $(t) = \frac{y\dot{x}^2 + y\dot{y}^2}{\dot{x}^2 - y^2} =$ M F $(\frac{1}{2}a) = \frac{\dot{x}^2 + \dot{y}^2}{-2\ddot{y}}$, ſince M E $(a) = \frac{\dot{x}^2 = \dot{y}^2}{= \ddot{y}}$, and by ſome Means of the $\dot{y} - 2y\ddot{y} + \dot{x}^2$, the Point P may be determined ſo, that drawing the incident Ray P M, and the reflected Ray M F, this latter will touch the Cauſtick A F K in the Point K, wherein it interſects the Axis A P.

Now in the Parabola $y = x^{\frac{1}{2}}$, $\dot{y} = \frac{1}{2}x^{-\frac{1}{2}}\dot{x}$, $\ddot{y} = -\frac{1}{4}x^{-\frac{3}{2}}\dot{x}^2$, and ſubſtituting the Expreſſions in the foregoing Equation, there will come out $\frac{1}{4}x^{-1}\dot{x}^2 + \frac{1}{2}x^{-1}\dot{x}^2 = \dot{x}^2$; and ſo we ſhall get A P $(x) = \frac{3}{4}$ of the Parameter.

Now to find the Nature of the Cauſtick A F K, after the Manner of *Deſcartes*, we muſt get an Equation expreſſing the Relation of the Abſciſs A R (u) to the Ordinate R F (z), which may be done thus: Becauſe M O $(t) = \frac{y\dot{x}^2 = y\dot{y}}{\dot{x}^2 - \dot{y}^2}$, therefore P O $\left(\frac{t\dot{y} + y\dot{y}^2}{\dot{x}}\right) = \frac{2y\dot{x}\dot{y}}{\dot{x}^2 - \dot{y}^2}$; and becauſe of the ſimilar Triangles M P O, M S F, therefore M O $\left(\frac{y\dot{x}^2 + y\dot{y}^2}{\dot{x}^2 - \ddot{y}}\right)$: M F $\left(\frac{\dot{x}^2 + \dot{y}^2}{-2\ddot{y}}\right)$ or $-2y\ddot{y}$: $\dot{x}^2 - \dot{y}^2$ :: M P (y) : M S $(y - z) = \frac{\dot{x}^2 - \dot{y}}{-2\ddot{y}}$ :: P O $\left(\frac{2y\dot{x}\dot{y}}{\dot{x}^2 - \dot{y}^2}\right)$ S F or P R $(u - x) = \frac{\dot{x}\dot{y}}{-\ddot{y}}$, therefore with $z = y + \frac{\dot{y}^2 - \dot{x}^2}{-2\ddot{y}}$, and $u = x + \frac{\dot{x}\dot{y}}{-\ddot{y}}$, together with the Equation of the given Curve, we get a new Equation freed from x and y, which expreſſes the Relation of A R (u) to F R (z).

When the Curve A M D is a Parabola, as in the Example, we ſhall get $z = \frac{3}{2}x^{\frac{1}{2}} - 2x^{\frac{3}{2}}$, or (ſquaring each Side) $\frac{3}{4}x - 6xx + 4x^3 = zz$, and $u = 3x$; whence we get the Equation ſought, $azz = \frac{4}{27}u^3 - \frac{2}{3}auu + \frac{3}{4}aau$, expreſſing the Nature of the Cauſtick A F K: Here we may obſerve, that P R is always the double of A P, becauſe A R $(u) = 3x$; from whence we get moreover another Way of determining the ſought Point F in the reflected Ray M F.

EXAMPLE II.

Let A M D be a Semicircle, the Line A D a Diameter, and C the Centre, and let the incident Rays P M be perpendicular to A D.

Becauſe the Evolute of the Circle is a Point, *viz.* the Centre of it, therefore if C M be biſected in H, and F H be drawn perpendicular to the reflected Ray M F, it ſhall cut the ſaid Ray in the Point F, wherein it touches the Cauſtick A F K: Now, becauſe the reflected Ray is equal to Half of the incident Ray P M; therefore when the Point P coincides with C, it is plain the Point F will coincide with K the Middle of C B, and the Part A F is the Triple of M F, and the Cauſtick A F K the Triple of B K, we may likewiſe obſerve, that when the Angle A C M is made one Half a Right-angle, the reflected Ray M F ſhall be parallel to A C; and therefore the Point F will be the higheſt Point of the Cauſtick above the Diameter A D.

The Circle, whoſe Diameter is the Line M H, paſſes thro' the Point F, becauſe the Angle H F M is a Right-angle; and if from the Centre C, with the Radius C K, or C H, the Half of C M, the Circle K H G be deſcribed, the Arch H F ſhall be equal to the Arch H K; for ſince the Angle C M F is equal to C M P, or H C K, the Arches Half H F and H K, that meaſure the ſaid Angles in the Circles M F H, K H G ſhall be to each other as the Radii Half M H, H C, of theſe Circles; whence it appears, that the Cauſtick A F K is a Cycloid generated by the Rotation of the Circle M F H, along the immovable Circle K H G, the Beginning thereof being K, and the Vertex A.

EXAMPLE III.

Let A M D be a Circle, the Line A D the Diameter, and the Point C the Centre; and let A, one End of that Diameter, be the luminous Point from whence all the Rays of Incidence A M iſſue.

From the Centre C draw C E perpendicular to the incident Ray A M, then from the Nature of the Circle, it is manifeſt that the Point E biſects the Chord A M, and ſo M E $(a) = \frac{1}{2} y$; whence M F $\left(\frac{a y}{2 y - a}\right) = \frac{1}{3} y$; that is, we muſt take the reflected Ray M F $= \frac{1}{3}$ A M the incident Ray, conſequently D K $= \frac{2}{3}$ A D, C K $= \frac{1}{3}$ C D, and the Cauſtick A F K $= \frac{4}{3}$ A D, like as its Part A F $= \frac{4}{3}$ A M, if you aſſume A M = A C, the reflected Ray M F will be parallel to the Diameter A D; and conſequently the Point F will be the higheſt Point poſſible above the ſaid Diameter.

If you take C H $= \frac{1}{3}$ C M, and draw H F perpendicular to M F, the Point F ſhall be in the Cauſtick, for drawing H L perpendicular to A M, it is manifeſt that M L $= \frac{2}{3}$ M E $= \frac{1}{3}$ A M, becauſe M H $= \frac{2}{3}$ C M; therefore the Circle having M H as a Diameter, ſhall paſs thro' the Point F of the Cauſtick; and if from the Centre C, with the Radius C K or C H, another Circle K H G be deſcribed, it ſhall be equal to the former one, and the Arch H K ſhall be equal to the Arch H F; for in the *Iſoſceles* Triangle C M A, the external Angle K C H = 2 C M A = A M F; and therefore the Arches H K, H F, being the Meaſures of thoſe Angles in the equal Circles, ſhall likewiſe be equal; whence it follows, that the Cauſtick A F K is likewiſe here a Cycloid generated by the Rotation of the Circle M F H, along the immovable one K H G, the Beginning being K, and the Vertex A.

This may be demonſtrated otherwiſe, thus: If a Cycloid be deſcribed by the Revolution of a Circle, equal to the Circle A M D about this ſame, beginning at A, we have demonſtrated, that the Cauſtick A F K will be the Evolute to the ſaid Cycloid taken as an Involute; but the ſaid Evolute is a Cycloid of the ſame kind, *viz.* the Diameters of the generating Circles of them ſhall be equal, and the Point K will be determined by taking C K a third Proportional to C D + D A and C D, *viz.* equal to $\frac{1}{3}$ C D; whence, *&c.*

EXAMPLE IV.

Fig. 11. Let the Curve A M D be one Half of a common Cycloid, deſcribed by the Rotation of the Semicircle N C M along the Right-line B D, whoſe Vertex is A, and the Beginning thereof D; and let the incident Rays K M be parallel to the Axis A B.

Fig. 11. Becauſe M G is equal to the Half of the Radius of Evolution; therefore if G F be drawn perpendicular to the reflected Ray M F, the Point F ſhall be in the Cauſtick D F B, and ſo M F muſt be aſſumed equal to K M.

If from H, the Centre of the generating Circle M G N, to the Point of Contact G, and to the deſcribent Point M, be drawn the Radii H G, H M, it is evident that H G will be perpendicular to B D, and the Angle G M H = M G H = G M K, whence the reflected Ray M F paſſes thro' the Centre H: Now the Circle having G H as a Diameter, paſſes thro' the Point F likewiſe; becauſe the Angle G F H is a Right-angle, therefore the Arches G N, Half G F, the Meaſures of the ſame Angle G H N, ſhall be to one another as the Diameters M N, G H, of their Circles, and conſequently the Arch G F = G N = G B; whence it is evident, that the Cauſtick D F B is a Cycloid deſcribed by the entire Rotation of the Circle G F H, along the Right-line B D.

EXAMPLE V.

Fig. 12. Let the Curve A M D be ſtill the Half of a common Cycloid, the Baſe B D whereof is equal to one Half the Circumference A N B of the generating Circle, and let the incident Rays P M be parallel to the Baſe B D.

If G Q be drawn perpendicular to P M, the right-angled Triangles G Q M, B P N, will be equal and ſimilar, and therefore M Q = P N; whence it follows, that M F muſt be aſſumed equal to the correſpondent Ordinate P N, in the generating Circle A N B.

When the Point F is at the greateſt Diſtance poſſible from the Axis A B, the Tangent M F in that Point muſt be parallel to the Axis, and conſequently the Angle P M F will be a Right-angle, and P M G, or P N B, Half a Right-angle; whence the Point P falls in the Centre of the Circle A N D.

Here it is worth obſerving; that as the Point P afterwards accedes towards the Extremity B of the Diameter, ſo does the Point F likewiſe accede toward the Axis A B, until it comes to a certain Point K; after which it recedes therefrom till it comes to D, ſo that the Cauſtick A F K F D has a Point of Retrogreſſion in K.

To determine which, we muſt obſerve that the Part A F = P M + M F, the Part A F K = H L + L K, and the Part K F of K F D, is = H L + L K − P M − M F, whence H L + L K muſt be a Maximum; and if you call A H, x; H I, y; the Arch A I, u; then will H L + L K $= u + 2 y$, the Fluxion whereof is $\dot{u} + 2 \dot{y} = o$, and $\frac{a \dot{x}}{y} + 2 \dot{y} = o$, by ſubſtituting $\frac{a \dot{x}}{y}$ for $\dot{u}$; from whence we get $a \dot{x} = -2 y \dot{y} = 2 x \dot{x} - 2 a \dot{x}$, becauſe of the Circle; and therefore A H $(x) = \frac{3}{2} a$.

COROL.

The Space A F M, or A F K F M, contained under the Parts of the Curves A F or A F K E, A M, and the reflected Ray M F is equal to Half of the circular Space A P N; for the Fluxion thereof, *viz.* the Sector F M O is equal to the Half of the Rectangle P p S N, the Fluxion of the Space A P N; ſince the right-angled Triangles M O m, M R m, being ſimilar and equal, M O ſhall be equal to M R or N S or P p, and moreover $MF = PN$.

EXAMPLE VI.

Fig. 13. Let the Curve A M D be the Half of a Cycloid generated by the Rotation of the Circle M G N about A G K equal to it, and let A be the Beginning thereof, and D the Vertex; and let the incident Rays A M all iſſue from the Point A, the Line B H joining the Centres of the generating Circles, conſtantly paſſes thro' the Point of Contact G, and the Arches G M, G A, as alſo their Chords, are always equal; alſo the Angle $HGM = BGA$, and the Angle $GMA = GAM$: Now the Angle $HGM + BGA = GMA + GAM$; becauſe if the Angle A G M be added to each Side, there will be two Right-angles made, whence the Angle H G M ſhall be always equal to the Angle G M A, and ſo likewiſe to the Angle of Reflexion G M F: whence it follows, that M F always paſſes thro' H, the Centre of the movable Circle.

Now if C E, G O, be drawn perpendicular to the incident Ray A M, it is manifeſt that $MO = OA$, and $OE = \frac{1}{3} OM$, ſince the Point C being in the Evolute, $GC = \frac{1}{3} GM$; therefore $ME = \frac{2}{3} AM$; that is, $a = \frac{2}{3} y$, and conſequently $MF \left(\frac{ay}{2y - a}\right) = \frac{1}{2} y$; whence, if you draw G F perpendicular to M F, the Point F will be in the Cauſtick A F K.

The Circle, whereof G H is a Diameter, does paſs thro' the Point F; and ſince the Arches G M, $\frac{1}{2}$ G F, the Meaſures of the Angle G H M are to one another as the Diameters M N, G H, of their Circles, the Arch G F ſhall be equal to G M, and conſequently to the Arch G A; from whence it is evident, that the Cauſtick A F K is a Cycloid generated by the Rotation of the movable Circle H F G, about or along the immovable one A G K.

COROL.

If a Circle be deſcribed about the Centre B, with a Radius equal to B H or A K, and an infinite Number of Right-lines parallel to B D, falls on the Circumference of it, it is then manifeſt, that by their Reflexion they will form the ſame Cauſtick A F K.

EXAMPLE VII.

Fig. 14. Let A M D be a Logarithmic Spiral, and let the incident Rays (A M) all iſſue from the Centre A.

If the Right-line C A be drawn from C, the End of the Radius of Evolution, perpendicular to the incident Ray A M, it ſhall meet the ſame in the Centre A; therefore $AM\ (y) = a$, and conſequently $MF \left(\frac{ay}{2y - a}\right) = y$, whence A M F ſhall be an *Iſoſceles* Triangle; and ſince the Angles of Incidence and Reflexion A M T, F M S, are equal to one another, the Angle A F M is equal to the Angle A M T; whence it is manifeſt, that the Cauſtick A F K will be a Logarithmic Spiral, differing only from the propoſed one A M D in Poſition.

PROP. II.

Fig. 15. The Cauſtick H F by Reflexion, and the luminous Point B being given, to find an infinite Number of Curves, as A M, whereof the ſame is the Cauſtick by Reflexion.

Take the Point A at Pleaſure, in any Tangent H A, for one of the Points of the Curve A M ſought; and from the Centre B, with the Diſtance B A, deſcribe the circular Arch A P; and with any other Diſtance B M, another circular Arch; then aſſume $AH + HE = BM - BA$ or P M; and by the Evolution of the Cauſtick H F, beginning at E, deſcribe the involute Curve, cutting the circular Arch deſcribed with the Radius B M in the Point M, which will be in the Curve A M; for by Conſtruction, $PM + MF = AH + HF$.

Or elſe take a Thread B M F, and having fixed one End in B, and the other in F, ſtretch the Thread by means of a Pin at M, which ſo move along, that the Part M F of the Thread wraps about the Cauſtick H F; then it is evident, that the Pin M in thus moving, deſcribes the Curve M A ſought.

Otherwiſe thus: Draw any Tangent (F M) excepting H A, at Pleaſure, and in the ſame find the Point M ſuch, that $BM + MF = BA + AH + HF$; which may be done thus:

Aſſume $FK = BA + AH + HF$, and biſecting B K in G, draw the Perpendicular G M, this ſhall interſect the Tangent F M in the ſought Point M for $BM = MK$.

Fig. 16. If the Point B be ſuppoſed at an infinite Diſtance from the Curve A M; that is, if the incident Rays B A, B M, be parallel to a Right-line given in Poſition, the former Conſtruction will ſerve likewiſe in this Caſe, in conceiving the Arches deſcribed from the Centre B, to become Right-lines perpendicular to the incident Ray: But the latter Conſtruction will not do here, for which we ſhall lay down the following one.

Aſſume $FK = AH + HF$, and find the Point M ſuch, that M P (a Parallel to A B) perpendicular to A P, be equal to M K, then it is plain that M will be the Point ſought in the Curve A M, becauſe $PM + MF = AH + HF$. Now this is done thus:

Draw K G perpendicular to A P, and aſſuming $KO = KG$, draw K P parallel to O G, and P N parallel to G K; I ſay the Point M will be that required: For, becauſe of the ſimilar Triangles G K O, P M K, P M will be equal M K, ſince $GK = KO$, if the Cauſtick H F degenerates into a Point, the Curve A M will become a *Conic* Section.

COROL. I.

Hence it is manifeſt, that the Curve which paſſes thro' all the Points K, is generated by the Evolution of the Curve H F, beginning at A, and that its Nature varies according as the Situation of the Point A in the Tangent A H varies: wherefore, becauſe the Curves (A M) are all generated by the ſame Geometrical Conſtruction from the ſaid Curves, it is manifeſt that the Nature of them differ, and they are only Geometrical when the

Cauſtick H F is a Geometrical Curve, and rectifiable.

COROL. II.

Fig. 17. A Curve D N, together with the luminous Point C being given, to find any Number of Lines (as A M) being ſuch, that they may cauſe all the Rays D A, N M, reflected from them, to unite in a given Point B.

If the Curve H F be ſuppoſed to be the Cauſtick of the given Curve D N, formed by the luminous Point C, it is manifeſt that the ſaid Line H F muſt likewiſe be the Cauſtick of the Curve A M, having the given Point B as a luminous Point; ſo that $FK = BA + AH + HF$, and $NK = BA + AH + HF + FN = BA + AD + DC - CN$, ſince $HD + DC = HF + FN + NC$, which gives this Conſtruction.

In any reflected Ray aſſume the Point A at Pleaſure, for one Point in the ſought Curve A M; and in any other reflected Ray M N, aſſume the Part $NK = BA + AD + DC - CN$, and the Point M will be found as above.

CAUSTICK [Καυστικὰ of Καίω, *Gr.* to burn] Stones or Cauteries, are thus made of Lime and Gravelled-Aſhes: Put into a large Earthen Pan one Part of Quick-Lime, and two of Gravelled-Aſhes, or of Calcined-Tartar, both powdered and mixed; on theſe pour good Store of hot Water, and then leave the Matter to infuſe five or ſix Hours, then boil it a little; then filtrate thro' Cap-Paper, and evaporating the Liquor that paſſed the Filtre, a Salt will remain at the Bottom. Put this Salt into a Crucible, and melt and boil it till all the Humidity which came from the Water is exhauſted. The Matter will ſtill remain fluid; and when, by trying ſome of it on the End of a Spatula, you find it of a due Conſiſtence, and that it looks like Oil in the Bottom of the Crucible, caſt it into a Baſon, and cut it, and form it into Pieces while it is warm; put them quickly into a ſtrong Glaſs Bottle, with a ground Stopple of the ſame Metal, for they will diſſolve and be ſpoiled if the Air come to them. Theſe are the ſtrongeſt Cauteries that can be made, and are ſoon and eaſily prepared.

CAUSTICKS, or *Eſcharoticks*, are thoſe things which burn the Skin and Fleſh into an hard Cruſt, as burned Braſs, unquenched Lime, ſublimated Mercury, and hot Iron, *&c.*

CAUSUS [Καυσὸς, *Gr.*] or a *Burning Fever*, is that which is attended with a greater Heat than other continued Fevers, an intolerable Thirſt, and other Symptoms, which argue an extraordinary Accenſion of the Blood. *Blanchard.*

CAUTERISATION [of Καυτηριάζω, *Gr.*] is an artificial Burning made by a Cautery.

CAUTERIUM [of Καίω, *Gr.* to burn] in Surgery, is an Inſtrument made of Iron, Silver, or Gold, which, after it is heated, has an actual Power of burning into any thing: They differ in Bulk and Form.

It is ſometimes taken for a *Potential Cautery*, prepared of Lixiviums, or Lime and Soap.

CAUTERY [with *Surgeons*] a burning Medicine, or a Compoſition of ſeveral things, which either gnaw, burn off, eat through, or ſear the Parts: It is uſed chiefly in Abſceſſes, Impoſthumations, Ulcers, and Caries of the Bones, to open a Paſſage for the Diſcharge of ill Humours, and are either *Actual* or *Potential.*

Actual CAUTERIES are ſuch as produce an inſtantaneous Effect, as Fire, or a Red-hot Iron, which are uſually applied in the *Fiſtula lachrymalis*, after the Extirpation of Cancers, the Amputation of Legs, Arms, *&c.* in order to ſtop the *Hæmorrhages*, and produce a laudable Suppuration.

Potential CAUTERIES are Compoſitions of Cauſtick Medicines, ſuch as Quick-lime, Soap, and Chimney-ſoot, *&c.* often uſed in making of Iſſues, *&c.*

CAUTIONE *admittenda* is, a Writ that lieth againſt a Biſhop, for holding an excommunicate Perſon in Priſon for his Contempt, notwithſtanding he offereth ſufficient Caution or Pledge to obey the Commandments and Orders of the Holy Church from henceforth. *L.*

CAZEMATE, a Term in Fortification: See *Caſemate.*

CASERN: See *Caſern.*

CEGINUS, a fixed Star of the third Magnitude, in the Left-Shoulder of *Bootes*, whoſe Longitude is 194°. 5′. Latitude 49°. 33′. Right Aſcenſion 215°. 39′. Declination 29°. 27′.

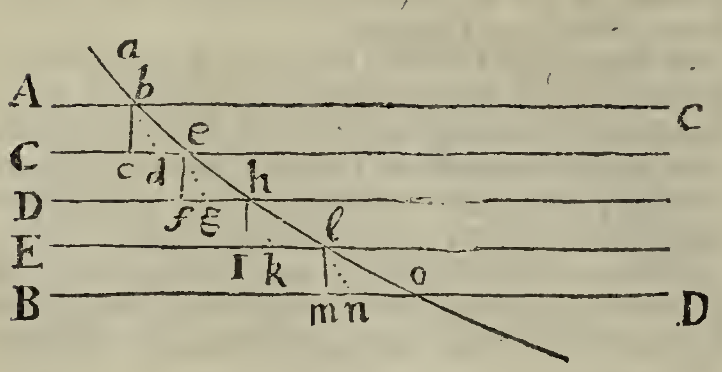
CELARENT [in *Logick*] a Syllogiſm whoſe ſecond Propoſition is an univerſal Affirmative, and the reſt univerſal Negatives.

CELATURE, the Art of Engraving; alſo the Figure engraved.

CELE [Κηλὴ, *Gr.*] is a Tumour or Swelling in any Part of the Body.

CELERITY is the Velocity or Swiftneſs of any Body in Motion; and it is defined to be an Affection of Motion by which any Moveable runs thro' a given Space in a given Time.

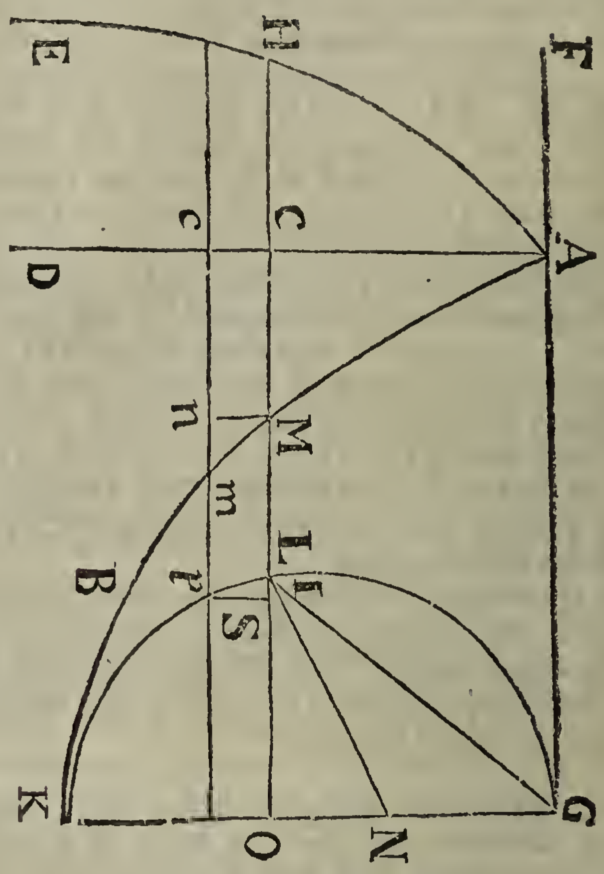
CELERRIMI *deſcenſus linea*, the Curve of the ſwifteſt Deſcent of any Body; or that in which an heavy Body, deſcending by its own Gravity, ſhould move from one given Point to another, in the ſhorteſt Time. This was propoſed as a Problem, by that excellent Mathematician, M. *John Bernouli*, Profeſſor of Mathematicks at *Groningen*; and he did afterwards ſhew that this Curve was the ſame with that which a Ray or Particle of Light deſcribes in *Mediums* which are not uniform; for in ſuch, a Rarity affects the Ray after the ſame manner as the Acceleration of Velocity doth the heavy Body in its Deſcent: For if any heavy Body deſcend from any given Point, and deſcribe a Curve, and hath its Velocity in a Subduplicate Ratio of the Altitude: And if a Particle of Light coming from a given Point, and paſs thro' a *Medium*, whoſe Rarity increaſes in a Subduplicate Ratio of the Altitude or Depth, then will the Velocity of the Particle or Ray of Light, be in a Subduplicate Ratio of ſuch Height or Depth; and conſequently, ſince the Velocity becomes the ſame, whether produced by the uniform Action or Gravity, or by the Rarity of the *Medium*, the Line of Deſcent or Motion, or the Curve deſcribed, will be in both Caſes the ſame. There have been publiſhed many Methods of inveſtigating the Nature of this Curve; and the following one (which is ſhort, plain, and eaſy) recommends itſelf to us, with this Advantage, that two noble Problems, in two diſtinct Sciences, are ſolved at one and the ſame time; the one an Optical one, and the other a Mechanical one;



Let us imagine the Medium A B C D to be made up of Fluids of ſeveral different Degrees of Denſities, but the Denſities (proceeding thro' the ſeveral Intervals of the Parallels A C, C e, D h, E l, B o, to encreaſe or diminiſh in a certain Law. In this Example we'll ſuppoſe the Degrees of Rarity in the Fluids to increaſe as we go from A towards B; ſo that the Ray a b is turned by the Refraction into b e, and b e into e h, and e h into h l, *&c.* from the Perpendicular b c, e f, h i, *&c.* at the Points of Incidence b, e, h, *&c.* the prick'd Lines being the ſeveral incident Rays produced. The refracted Ray intercepted between the Points b and o, *viz.* b e h o, is a Polygon made up of all the refracted Rays b e, e h, *&c.* which deflect from one another by the Angles of Refraction made at the ſeveral Points b, e, *&c.*

Now if the Diſtances of the Parallels are leſſened infinitely, the Polygon b e h l o becomes a Curveline; but alſo, the Curve-ray in its Paſſage thro' the ſeveral Mediums, is ſuppoſed to take ſuch a Courſe, that it comes from the radiating Point to the Point to be enlightened in the ſhorteſt Time, 'tis evident (ſince 'tis every where ſo throughout the Polygon b e h l o) that the Curve into which that Polygon degenerates (being the Curve which the Ray by the continual Refraction is bent into) is the Curve of ſwifteſt Motion, or that by which the Light paſſes from the Point b, to the Point o, in the ſhorteſt Time.

And ſince the Sines of the refracted Angles c b e, f e h, *&c.* are ſtill as the Rarities of the Mediums in thoſe ſeveral Points; that is, as the Velocities of the Globule of Light in thoſe Places; and ſince alſo thoſe refracted Angles are the Angles of the Inclination of the Lines b e, e h, *&c.* to the Perpendiculars b c, e f, *&c.* 'tis clear that the Curve muſt have this Property, that the Lines of the Inclinations to a Perpendicular, muſt be every where in the Ratio of the Celerities.



Now let the Law of the Rarity, or Denſity of the Medium, be what it will, we may thus in general proceed to determine the Curve. Let the Medium F G D K be determined by the Horizontal Line F G, to which A D is perpendicular, and is the Axis of the Curve A H E, whoſe Ordinate is H C; and let the Ordinate H C ſtill repreſent the Rarities of the Medium in the Depths A C, or, which is all one, the Velocities of the Globule of Light in the Points of the Curve M. The incurved Ray, or the *Semita* of the Globule is the Curve A M B, the Nature of which is to be enquired into. The Lines H C M and c n m are parallel to F G, and M n parallel to A D. Let $AC = x$, $Cc = Mn = \dot{x}$, $CM = y$, $nm = \dot{y}$, $AM = z$, $Mm = \dot{z}$, $HC = v$; and a, a ſtable Quantity taken at Liberty. If we put M m for Radius, 'tis plain that n m is the Sine of the refracted Angle (or of the Curve's Inclination to the Vertical-line M n at the Point M) therefore ſince the Sines of thoſe Angles are (as we ſaid before) always as the Celerities, then $\frac{\dot{m}n}{HC}$ is a conſtant Ratio; that is, $\frac{\dot{y}}{v}$ is a conſtant Ratio; ſo that $\frac{\dot{y}}{v} = \frac{\dot{z}}{a}$ (for the Fluxions $\dot{z}$ being taken equal, as they may then $\frac{\dot{z}}{a}$ is alſo a ſtable Ratio) and $a\dot{y} = v\dot{x}$, and $aa\dot{y}\dot{y} = vv\dot{z}\dot{z}$, but $\dot{z}\dot{z} = \dot{y}\dot{y} + \dot{x}\dot{x}$, therefore $aa\dot{y}\dot{y}vv\dot{y}\dot{y} + vv\dot{x}\dot{x}$, and $\dot{y} = \frac{a\dot{x}}{aa - vv}{}^{2}$, which is the general Equation in Fluxions for the Curve A M B. Now 'tis all one whether we conſider the Increments of the Velocity, as depending upon the Medium more or leſs reſiſting the Globule, or whether abſtracting from all Conſideration of a Medium, we ſuppoſe them to be the Effects of another Cauſe, but acting according to the ſame Law that was obſerved on the former, ſince on both Sides the Curve is ſuppoſed to be run in the ſhorteſt Time. Now if we imagine the Globule to be a heavy Body, and Gravity to be the Cauſe of the Acceleration; then the Curve A H E will be the common Parabola, ſince H C or v repreſents the Celerity for the Space x or A C; and in this Curve v is as $x^{\frac{1}{2}}$. The conſtant Line a being the Parameter, and ſo $v = \sqrt{ax}$; ſubſtituting this in the Room of v in the general Equation, we have $\dot{y} = \sqrt{:}\ \frac{x}{a-x} \times \dot{x}$. From hence it follows, that the Curve of the ſwifteſt Deſcent, *viz.* A M D, is the vulgar Cycloid, the Diameter of whoſe generating Circle G L K is $= a$, and whoſe Baſe is A G, and Vertex K, G K being perpendicular to A G. Two things ſet this in the cleareſt Light: 1. To prove that C M is $=$ *arc* G L — L O: And 2, from thence that M L is $=$ *arc* L K, which is the known Property of the Cycloid. That C M $=$ *arc* G L $=$ L O is certain, in that the Fluxions of them are perpetually equal in all Points of the Curve. Let L O $= s$, and the *arc* G L $= c$, and its Fluxion L $p = \dot{c}$; then ſince $s = ax - xx$, we have $\dot{s} = \frac{a\dot{x} - 2x\dot{x}}{\overline{2ax - xx}^{\frac{1}{2}}}$ Again, $\dot{c} = \frac{\frac{1}{2}a\dot{x}}{s} = \frac{a\dot{x}}{2s} = \frac{a\dot{x}}{\overline{2ax - xx}^{\frac{1}{2}}}$; therefore $\dot{c} - \dot{s} = \frac{2x\dot{x}}{\overline{2ax - xx}^{\frac{1}{2}}}, = \frac{x\dot{x}}{\overline{ax - xx}^{\frac{1}{2}}} = \sqrt{:}\ \frac{x}{a-x} \times \dot{x} = \dot{y}$; wherefore $c = s = \dot{y}$, and $c - s - y$, *viz.* C M $=$ Arch G L — L O. Now if C M $=$ G L — L O, then M O, which is $=$ C O — C M, is $=$ C O — G L $=$ L O: But C O $= \frac{1}{2}$ Circle G L K $=$ G L + L K; therefore M O, which is $=$ C O — G L + L O, is $=$ G L + L K — G L + L O; that is, M O is $=$ L K + L O, and taking away L O, M L $=$ L K: So that it is clear the Curve is the Cycloid above deſcribed. *Q. E. I.*

CELESTIAL *Globe*: See *Globe.*

CELIACK *Paſſion*: See *Coeliack.*

CELLS [with *Anatomiſts*] are little Baggs or Bladders, where Fluids or other Matters are contained, the ſame that are called *Loculi* and *Cellulæ.*

CELLULÆ *adipoſæ* [in *Anatomy*] thoſe *Loculi*, or little *Cells*, wherein the Fat of Bodies in good Habit are contained.

CELOTOMY [of Κήλη a *Rupture*, called *Hernia*, and τέμνω, *Gr.* to cut] the Operation of the *Hernia.*

CEMENT is both the Name of a Paſte with which Plates of Gold being ſtratified are purified, and, according to *Helmont*, and many others, is any Lute by which the Necks of Veſſels in Diſtillation are joined, or, as we commonly ſay, *cemented together.*

CEMENT [in *Architecture*] is a ſtrong binding Mortar: It is uſed to cement Bricks together for ſome kinds of Mouldings, to make a Block of Bricks for the carving of Scrolls, Capitals, *&c.* 'Tis of two Sorts: The *Hot Cement*, which is common, is made by putting to a Pound of Rozin and a Quarter of a Pound of Bees Wax, Half an Ounce of fine Brick-duſt, and as much Powder of Chalk; and boiling all together in a Pipkin, *&c.* for about a Quarter of an Hour, ſtirring it all the while; then let it ſtand four or five Minutes, and 'tis fit for Uſe.

The Bricks to be cemented muſt be heated in or by the Fire, and rubb'd one upon another like Boards in glewing.

The *Cold Cement* is leſs common, and is thus made:

Grate Half a Pound of old *Cheſhire* Cheeſe, well pared, very ſmall, put it in a Pot, and put Half a Pint of Milk, and ſo let it ſtand all Night; the next Morning put it into a Tray, *&c.* With the Cheeſe and Milk, put Half a Pound of very fine powdered and ſifted Quick-lime, and ſtir all well together with a Trowel, breaking the Knots of the Cheeſe, if any remain; and then add the Whites of 12 or 14 Eggs, which incorporate well with the Mixture, and then it will be fit for Uſe: If you would have it reddiſh, colour it with a little very fine Powder of Bricks. And alſo, *Cement* is the ſame as

CEMENTATION, which is one of the Ways of purifying of Gold, and, as ſome ſay, of Silver; and 'tis thus done: Stratify, in a Crucible, thin Plates of Gold and Cement, *i. e.* the Paſte of that Name, which is made of one Part of *Sal Armoniack*, two Parts of *Sal Gemmæ*, and four Parts of *Potters-Earth* or *Powder'd-Brick*, and covering the Crucible, make a violent Fire round about it, to calcine the Matter for 10 or 12 Hours, that the corroding Salts may carry off the Impurities of the Gold: But this Purification is by no means ſo good as that made with *Antimony* (which ſee under the Word *Purification*) for theſe Salts do ſometimes leave other Metals remaining with the Gold, and beſides, do often eat away the very Gold itſelf.

CENCHRIAS [of Κέγχρος, *Gr. Millet*] is a ſort of ſpreading Inflammation, running like Wildfire; called alſo *Herpes Miliaris*, from the Reſemblance it bears to the Seed of the ſmall Grain called *Millet* or *Hyrſe. Blanchard.*

CENEANGIA [of Κενόω *to empty*, and ἄγγος, *Gr.* a *Veſſel*] is, with ſome, the ſame as *Phlebotomy* or *Blood-letting.*

CENOSIS [Κένωσις, *Gr.*] a diſcharging of Humours out of the whole or ſome part of the Body.

CENTAUR, a Southern Conſtellation, conſiſting of 40 Stars.

CENTESM is the Hundredth-part of any thing, and is commonly mentioned in our new Decimal Diviſions of Degrees, Feet, *&c.*

CENTRAL-RULE is, a Rule found out and eſtabliſhed by our famous Mr. *Tho. Baker*, late Rector of *Nympton* in *Com. Devon.* whereby he finds the Centre of a Circle deſigned to cut the Parabola in as many Points as an Equation to be conſtructed hath real Roots. How by this means he conſtructed all Equations as far as Biquadraticks, you will find under the Word *Conſtruction of Equations*: And the Demonſtration of his *Central Rule* I give here by itſelf.

The Rules of Mr. *Baker* are theſe:

I.

$$\frac{L}{2} + \frac{q}{8L} = b = CD.$$

II.

$$\frac{p}{4} + \frac{ppp}{6LL} + \frac{pq}{4LL} + \frac{r}{2LL} = d = DE.$$

Or by Contraction, becauſe $L = 1$, as I ſuppoſed, to avoid Fractions:

1.

$$\frac{1}{2} + \frac{pp}{8} \pm \frac{q}{2} = b = CD.$$

2.

$$\frac{1}{4}p \pm \frac{1}{6}ppp \pm \frac{1}{3}pq \pm \frac{1}{2}r = d - ED.$$

To diſcover the Reaſon of which Rules,

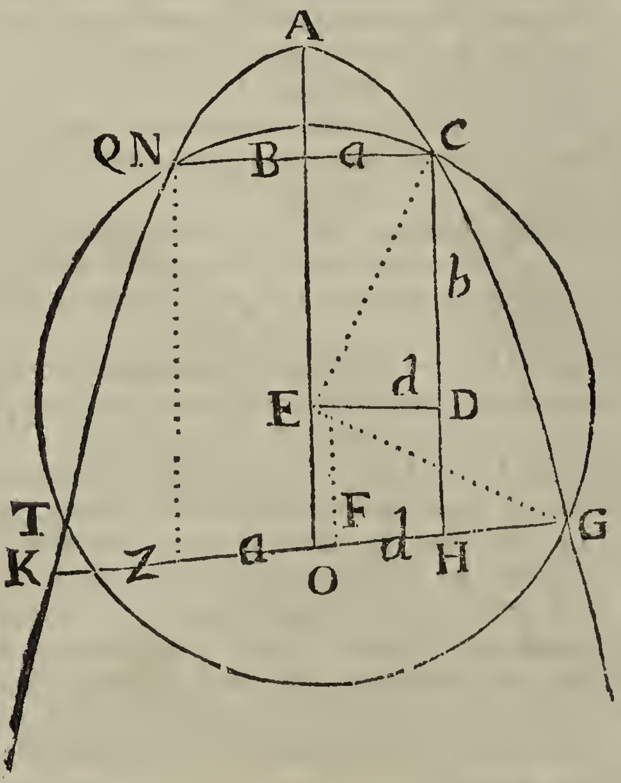
Suppoſe any Parabola drawn as in the following Figure, then this Lemma may be premiſed: That the Line KG being an entire Ordinate, and cutting the Diameter CH conſequently at Right-Angles in the Point H, 'tis plain by Mr. *Baker's* Property of the Parabola, that L : HK (the Sum of the two Ordinates GO + OH, or BC) :: As HG, the Difference of theſe Ordinates, is to HC the Abſciſſa; wherefore the Rectangle under L the *Latus Rectum* or Parameter, and CH the Abſciſſa, is equal to that under KH and HG, or to the Rectangle KHG.

Suppoſe then Mr. *Baker's* L, the Parameter or *Latus Rectum* belonging to this Parabola $= p$.

Let $CD = b$, $CB = a$.
$DE = d = FH$.
$GH = z$, the Root ſought: Then will
$FG = z + d$, and
$HK = 2a + z$.

And conſequently, by the *Lemma*,

$$\boxed{p\ (\text{or } L)\ x^{d},\ \text{by } CH = 2az + zz.}$$



Wherefore $CH = \frac{2az + zz}{p}$, and $EF = DH = \frac{2az + zz}{p} - b$. But $EFq + FGq = CEq = CDq + EDq$; that is, $\frac{4aazz + 4az^3 + z^4}{pp} - \frac{4baz + 2bzz}{pp} + bb + zz + 2zd + dd = bb + dd$. Expunge $bb + dd$, and there will remain $\frac{4aazz + 4az + z}{pp} - \frac{4ba - 2bzz}{p} + zz + 2dz = 0.$

Then if you firſt multiply all that Equation by pp, and divide it afterwards by z, you will bring it to this, $4aaz + 4azz + z^3 - 4pba - 2pbz + ppz + 2ppd = 0.$

Or, to reduce it to a more regular Form:

$$Z^3 + 4azz \begin{array}{l} + ppz \\ + 4aaz \\ - 2pbz \end{array} \begin{array}{l} - 4apba \\ + 2ppd \end{array} = 0:$$

Or, if you had called the whole Line CQ by the Name of a (as *Baker* calls it p) the Equation would ſtand thus:

$$Z^3 + 2azz \begin{array}{l} + ppz \\ + aaz \\ - 2bpz \end{array} \begin{array}{l} - 2bpa \\ + 2pba \end{array} = 0.$$

Now compare this Equation, Member by Member, with one given to be ſolved in the uſual Form; as ſuppoſe,

$$Z^3 + mzz + rz + S = 0.$$

Drawing any Parabola, take $QC = \frac{1}{2}m$ (becauſe $2a = m$) and apply it into the Parabola at Right-Angles to the Axis AO: Next, compareing the Coefficients in the two next correſpondent Terms, you have $pp + aa - 2pb = r$, or $pp + \frac{1}{2}mm - 2pb = r$: And conſequently, $b = \frac{pp + \frac{1}{4}mm - r}{2p} = \frac{1}{2} + \frac{mm}{8p} - \frac{\frac{1}{2}r}{p}$.

Which is the Rule to find CD, or to determine the Point D, nearly the ſame (changing only the Letters) with *Baker's firſt Rule.*

Then again, compare the next two correſponding Terms in both Equations together, and you have $2ppd - 2bpa = S$; wherefore $d = \frac{S + 2dpa}{2pp}$: Which being all a known Quantity, the Line ED is known, and conſequently the Centrical Point E of the Circle to be deſcribed, whoſe Radius will be EC or EG, and which will cut the Parabola ſo as to give you the Points G, T, and N; from whence letting fall Perpendiculars to the Diameter CH, they ſhall be the three real Roots of this Cubick Equation, $zzz + mzz + rz + S = 0$.

And, which are Negative, and which are Affirmative, you will find in the *Conſtruction* of theſe Equations by the *Parabola*: Which ſee.

If the Equation had been a Biquadratick, as ſuppoſe,

$$Z + mz - nzz + \text{[illegible]} - S = 0.$$

Then the Circle would not have paſſed thro' the Vertex of the Diameter, but thro' another Point to be found according to the Rules mentioned in *Des Cartes's* Conſtruction of Equations; which is, to let $\surd : \frac{S}{pp}$ (if S repreſent the abſolute Number or Fifth Term in ſuch an Equation, and have a Negative Sign) at Right-angles to EC, on the Vertex of the Diameter; but if it be + S, then that Line $\surd : \frac{S}{pp}$ muſt be inſcribed to another Semicircle made on the Line EC; which being ſet from the Vertex of the Diameter C, will give in the Periphery of that Semicircle on EC, a Point through which the interſecting Circle required ſhall paſs. See the Manner how the *Central Rule* is inveſtigated in the laſt Term of a Biquadratick, according to this Method of Mr. *Baker*, under the Word *Conſtruction.*

From which appears,

The *Analytick* Method by which Mr. *Baker* found this Rule; for a Parabola being deſcribed, and a Point in its Plane given in Poſition, he expreſſes two Ways, the Radius of a Circle paſſing thro' the Vertex of any Diameter; that is, by Poſition of the given Centre: And Application of this new Property, (*That the Rectangle made of the Parameter and Difference of the Abſciſſa, is equal to the Rectangle made of the Sum of the two Ordinates into their Differences*) to expreſs the Ratio of the Radius to the given Line of the Parabola; ſo having an Equation of four Dimenſions, and rejecting the Equals on both Sides, he depreſſes it to a Cubick; but adjoining to it a Quantity for the *Homogeneum Comparationis*, thereby making the Whole equal to nothing, the Equation ſubſiſts in a Biquadratick, having all its Terms; if the Circle be ſuppoſed to paſs, not thro' the Vertex of the Diameter, but thro' a Point which, being joined with the Vertex and the Centre, may terminate a Right-angled Triangle

This Equation he compares with another like it, and equal to it; then by equating the Coefficients of theſe two Equations, he preſently diſcovers the *Central-Rule*, whoſe Univerſal Extent appears in Biquadratick Equations, affected under all Parodick Degrees; for all the other Caſes where any other Terms ate wanting, are but *Corollaries*, or more compendious Conſtructions derived from the general Rule: So that the Invention of the Rule ſeems as much due to the laſt Equation of the Coefficient, as to the aforeſaid Properties, which is demonſtrated by *Archimedes* in the *Section* of *the Parabolick Conoid by a Plane parallel to the Axis*, and is particularly uſed by *Sluſius* in his *Analyticks*, who thereby conſtructs a Biquadratick Equation, keeping all its Terms. But then the *Analyſis* of *Sluſius*, by breaking the Equation into two others, to find two Places, is very different from that whereby our Author found his *Central-Rule*, than which nothing can be expected more eaſy, ſimple, or univerſal, ſeeing any Parabola, being once for all deſcribed, will give all the Roots, true or falſe, of any Equation, without Reduction, or any Alteration whatſoever.

CENTRE *of Attraction*, [in the *New Aſtronomy*] is that Point to which the revolving Planet or Comet is impelled, or attracted, by the Force or Impetus of Gravity. Thus the Sun is ſuch a Centre of Attraction, with regard to all the Primary Planets, and as they themſelves are toward their Secondary ones, or Satellites, if they have any.

CENTRE *of a Baſtion* is a Point in the Middle of the Gorge of a Baſtion, whence the Capital Line commences, and which is uſually at the inner Polygon of the Figure.

CENTRE *of a Battalion*, the Middle of a Battalion, where there is uſually left a large ſquare Space for lodging the Clothes and Baggage.

CENTRE *of a Circle*, or *of a Sphere*, is that Point from whence all Right-lines drawn to the Circumference, or Surface, are equal. To find the *Centre of a Circle*, ſee *Chord.*

CENTRE *of a Conick-Section*, is the Point where all the Diameters concur.

CENTRE *of a Curve* of the higher kind, is a Point where the two Diameters concur.

CENTRE *of a Dyal* is that Point where the Axis of the World interſects the Plane of the Dyal; and from thence, in thoſe Dyals that have Centres, all the Hour-Lines are drawn. If the Plane of the Dyal be parallel to the Axis of the World, it can have no Centre at all, but all the Hour-Lines will be parallel to the Style, and to one another.

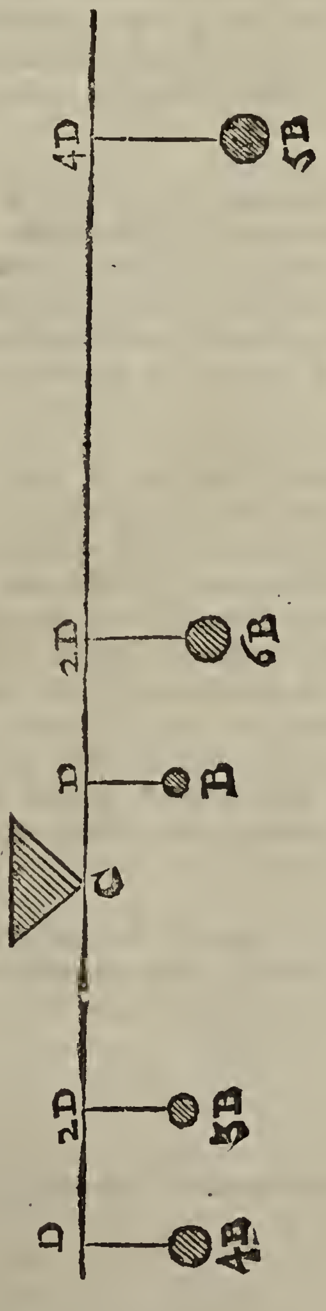
CENTRE *of an Ellipſis* or *Oval*, is that Point where the two Diameters, the Tranſverſe and the Conjugate, interſect each other.

CENTRE *of the Equant* [in *Aſtronomy*] is a Point in the Line of the *Aphelion*, being exactly diſtant ſo far from the *Centre of the Eccentrique*, towards the *Aphelion*, as the *Sun* is from the *Centre of the Eccentrique* towards the *Perihelion.*

CENTRE *of Gravitation* [in *Phyſicks*] is that Point to which a revolving Planet or Comet is impelled, or attracted, by the Force or Impetus of Gravity; called alſo the *Centre of Attraction.*

CENTRE *of Gravity* [of any Body] is a Point on which a Body being ſupported, or from it ſuſpended, all its Parts will be in Æquilibrio to one another.

The Conſideration of the *Centre of Gravity* is one of the nobleſt Speculations in *Geometry*; and ſince the New Methods have been in Uſe, ſuch Advancements in it have been made, that hardly much more is to be expected: For the whole Buſineſs of the *Inveſtigation of Centres of Gravity* is now reduced to one *General Propoſition*, which depends on a few ſimple *Mechanical Principles*, ſuch as theſe:



Ballance, as that their Maſſes be reciprocally proportional to their Diſtances from C the Point of Suſpenſion, then they will be in Æquilibrio, as is the known Caſe of the *Libra* (ſee *Libra*); that is, if D repreſent the Diſtance of the Weight B, and 3 D that of 4 B, and 2 D that of 6 B, all from the Point of Suſpenſion C; then will the Weights 4 B and 6 B be in Æquilibrio, becauſe 3 B : 6 B :: 2 D : 3 D.

2. The Moment of any Weight is equal to the Rectangle under its Velocity, and the Quantity of Matter in the ſame, *v. g.* the Moment of 6 B is = 6 B × 2 D (2 D, I ſay, for the Velocities are as the Diſtances from C) = 12 B D.

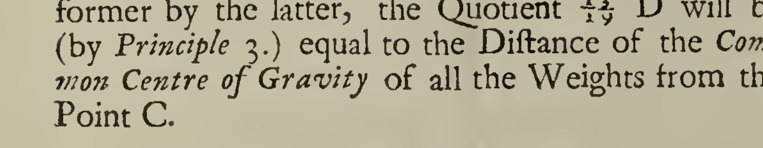
3. And if the Moment and Weight (or Quantity of Matter) be given, the Diſtance of the Point of Application from C the Point of Suſpenſion will be found, by dividing the Moment by the Weight. Thus, if the Moment of the Weight 6 B be 12 B D (as in *Principle* 2.) then the Diſtance of the Point of Application from C will be $\frac{12\,BD}{6\,B} = 2\,D$.

4. If ſeveral Bodies be ſuſpended on each Side the Point C, then multiply every Weight by its reſpective Diſtance from the Centre of Suſpenſion C: And then if the Sum of all the Rectangles on one Side, be equal to the Sum of all thoſe on the other, the Weights or Bodies will be in Æquilibrio; if they are not equal, that Side will preponderate whoſe Sum is the greater. Thus, *v. g.* the Sum of all the Rectangles on the Right-hand C, is 18 B D: I ſay, + 18 B D (ſuppoſing + to ſignify towards the Right-hand, and — towards the Left; and the Sum of all the Rectangles on the Left of C, will be — 33 B D: Whence it is evident, that the Preponderancy is toward the Left-hand, and is = to — 15 B D; which therefore is the Moment of all the Weights.

5. The Moment then of all the Weights being in this Caſe — 13 B D, and the Sum of all the Weights 19 B D; it is plain, that if you divide the former by the latter, the Quotient $\frac{13}{19}$ D will be (by *Principle* 3.) equal to the Diſtance of the *Common Centre of Gravity* of all the Weights from the Point C.

6. When the Weights, B, 6 B, and 5 B, hang all on the ſame Side of C, the Sum of their Moments is = 33 B D, as the Sum of the Weights is 12 B: Wherefore one Weight = 12 B, and hung at $\frac{33}{12}$ D diſtant from C, will gravitate in the ſame manner as the ſeparate Weights did before at their reſpective Diſtances; that is, the ſaid Point is the *Common Centre of Gravity* of thoſe Weights, ſince it is that Point in which all their Forces unite; and whereat, if they are all jointly ſuſpended, they would produce the ſame Effect as before they did ſeparately.

7. Let the Line A B be ſuſpended at A, and ſuppoſe it divided into an infinite Number of heavy Points; 'tis then plain, that the farther any Point is from A, the more it will gravitate; and the Moment of each Point will be a Rectangle under its Diſtance from A, multiplied by itſelf or Unity; wherefore the Moment of all the Points muſt be = to the Sum of all the ſaid Rectangles; and therefore, if the *whole Moment* be divided by the *whole Gravity* of all the Points, or by the Gravity of the whole Line A B, the Quotient (by *Principles* 3 and 6.) will be = to the Diſtance of a certain Point from A, at which, if all the Points be ſuſpended, their *Moment* will be the ſame as it is now; that is, that Point ſhall be the *Common Centre of Gravity* of the Line A B.



8. If a Line, Plane, or Solid, be biſected ſo by a Line or Plane, as that all the Parts in one Segment be equal to the reſpective Parts in the other, and alſo equidiſtant from the ſaid Line or Plane; 'tis then clear, that the Centre or Gravity of all ſuch Figures muſt be in that Line or Plane. And from hence it naturally follows:

General Propoſition.

That to find the *Centre of Gravity* of any Line, Plane, or Solid, you muſt imagine Lines to conſiſt of an infinite Number of Points; Planes of an infinite Number of Lines; and Solids of an infinite Number of Planes, or Surfaces: And then, that all theſe are ſuſpended to the ſame Arm of a Ballance common to them all. And let the Point of Suſpenſion be as in A, at the End or Extreme of the ſaid Line in the Edge of the Surface, or in the Surface of the Solid; and then find the Sum of the Moments of all thoſe Points; which Sum divide by the Sum of the Weights, or the Weight of all the Parts, and the Quotient will be the Diſtance of the *Centre of Gravity*, or the Line, Plane, or Solid, from the Point or Axis of Suſpenſion. The Practice of all which, in particular Inſtances, ſee in *Hayes*'s *Fluxions*, p. 261, *&c.*

CENTRES *of Gravity.* 'Tis plain that the Centre of Gravity of a Circle, and of a Sphere or Globe (ſuppoſing the Matter truly homogeneous all over them) will be their Centre of Magnitude; the Centre of Gravity of all Parallelograms will be in the Point of Interſection of the two Diagonals; and the Centre of Gravity of all ſolid Parallelograms, or Parallelopipeds, will be in the ſame Point of the *Plane of Gravity*, i. e. in the Point found to be the common Interſection of the two Diagonals of that Plane which cuts the Solid into two Triangular Priſms, and conſequently is eaſily found. The Centre of Gravity of all Planes of Triangles, is in the Point of Interſection of two Right-lines, biſecting any two of their Angles; and of all ſolid Triangles, or Triangular Priſms, it will be in the middle Point of the *Diameter of Gravity*; and that Diameter is found by the common Interſection of two Planes, each of which biſects one Angle of the Top and Baſe, and conſequently of all the Triangles of which the Priſm may be conceived to be compoſed.

If the Priſm be of a Quadrilateral, or any other more compounded Form, the Thing will be more difficult, becauſe the Centre of Gravity will lie at a proportionable Diſtance from the Centre of Gravity of all the Triangular Priſms, that the Multangular Solid can be divided into: But tho' this be a little more troubleſome, 'tis by no means impoſſible, any more than to find the Centres of Gravity of *Cones*, *Pyramids*, *&c.* for which you have Rules enough in *Stephanus*, lib. 2. *Elemen. Stat.* and in many other Authors.

CENTRE [*common*] *of the Gravity of two Bodies*, is a Point in a Right-line connecting their Centres, and ſo poſited in that Line, that their Diſtances from it ſhall be reciprocally as the Weight of theſe Bodies: And if another Body be placed in the ſame Right-line, ſo that its Diſtance from any Point in it be reciprocally as the Weight of both the former Bodies taken together, that Point ſhall be the *Common Centre of Gravity* of all Three, *&c.*

CENTRE *of heavy Bodies* is, in our Globe, the ſame as the *Centre of the Earth*, towards which all heavy Bodies do, as it were, naturally tend.

CENTRE *of an Hyperbola*, or *Ellipſis*. In theſe Curves, and in the oppoſite Sections of Hyperbola's, all the Diameters terminated in the Section (or in the oppoſite Sections) do naturally biſect one another, in one and the ſame Point, which Point is called the *Centre*. And this Point in the Ellipſis is within the Figure, but in the Hyperbola without, being there the Middle of the *Latus Tranſverſum*.

CENTRE *of Magnitude* of any Body, is that Point which is equally remote from its extreme Parts.

CENTRE of *Motion* of any Body, is that Point about which any Body moves, when faſtened any way to it, or made to revolve round it.

CENTRE *of Oſcillation*. That Point of any Figure where all the Forces are united is but one, (ſuppoſing the Figure to revolve round a Point or Axis) and conſequently only one ſingle Pendulum can be made, whoſe Vibrations (the Forces in both being equal) ſhall be *Iſochronical* to thoſe of the whole Solid ; and becauſe that Point in the Figure wherein all the Forces are ſo united, determines the Length of the *Simple Iſochronical Pendulum*, and is that wherein all the Figure is ſuppoſed to be contracted with all the Forces, while it vibrates ; therefore 'tis called the *Centre of Oſcillation:* And ſince the Centres of *Percuſſion* and *Oſcillation* in every Figure are the ſame, the way of Inveſtigation of both muſt be the ſame. See *Centre of Percuſſion.*

CENTRE *of a Parallelogram*, or *Polygon*, is the Point wherein its Diagonals interſect.

CENTRE *of Percuſſion* of a Body in Motion, is that Point wherein all the Forces of that Body are conſidered as united in one ; ſo that the Force of Percuſſion in that Point is greater than any where elſe ; ſo that the Centre of Percuſſion is the ſame with reſpect to the Forces, as that of Gravity is in reſpect of the Weights.

In calculating the *Centres of Gravity*, we ſuppoſe the Figures to be ſimply ſuſpended to a Point or Axis: But, in order to calculate the *Centres of Percuſſion*, the Figures are ſuppoſed to be actually revolving about a Point or Axis ; and as *there*, the *Simple Momenta* are conſidered ; *here*, they are conſidered alſo with the Velocity ſuper-added. And as the Sum of all the *Simple Momenta* on each Side the Centre of Gravity are equal, ſo here the Sum of all the Forces on every Side the Centre of Percuſſion muſt be equal: And therefore, as the Centre of Gravity is found by dividing the Sum of all the Moments by the Sum of all the Weights ; ſo to find the Centre of Percuſſion, you muſt divide the Sum of all the Rectangles under all the *Momenta*, and their reſpective Velocities, by the Sum of all the Moments. See more of this in *Hayes's Fluxions*, p. 281.

CENTRE *of a Regular Polygon*, or *Regular Body*, is the ſame with that of the inſcribed Circle or Sphere.

CENTRIFUGAL *Force*, is that Force by which all Bodies which move round any other Body, in a Circle or an Ellipſis, do endeavour to fly off from the Axis of their Motion in a Tangent to the Periphery of it : And this Force, as Mr. *Huygens* demonſtrates, is always proportional to the Circumference of the Curve in which the revolving Body is carried round.

The *Centrifugal Force* of any Body to the *Centripetal*, is as the Square of the Arch which a Body deſcribes in a given Time, divided by the Diameter, to the Space thro' which an heavy Body moves, in falling from a Place where it was at reſt in the ſame time.

If any Body ſwim in a Medium heavier than itſelf (and in one lighter it cannot do ſo) the *Centrifugal Force* is the Difference between the Specifick Weight of the Medium and the Floating Body.

What the *Centrifugal Force* in the Planets is, or the *Conatus Recedendi ab Axe motus*, the Endeavour to recede from the Axis of the Motion, you will find explained under *Planets*, where the Reaſon of all their Motion is expounded.

All moving Bodies endeavour after a Rectilinear Motion, becauſe that is the eaſieſt, ſhorteſt, and moſt ſimple: Whenever therefore they move in any Curve, there muſt be ſomething that draws them from their Rectilinear Motion, and detains them in the Orbit. Whenever this Force (which is called *Centripetal*) ceaſes, which attracts them towards a Centre, the moving Body would ſtrait go off in a Tangent to the Curve in that very Point, and ſo would get ſtill farther and farther from the Centre or Focus of its former Curvilinear Motion : And that Endeavour to fly off in the Tangent is the *Centrifugal Force*. The Effect of this Force is ſuch, that if a moving Body were to deſcribe a Circle, it would cauſe it to diſcharge the largeſt poſſible, becauſe a great Circle is leſs curved, and differs leſs from a Right-line than a ſmall one : A moving Body therefore will ſuffer more Violence of Attraction, and conſequently will exert more of its Centrifugal Force when it deſcribes a leſs Circle, than in a greater.

Is it much the ſame in other Curves as in the Circle ; for every Curve may be conſidered as compoſed of an Infinity of Arks of infinitely ſmall Circles, all deſcribed by different Radii ; and ſo, that where the Curve hath the greateſt Curvature, there it is compoſed of ſuch Arks as are Portions of the leaſt Circles, or which are deſcribed by the ſhorteſt Radii : A Body therefore moving in a Curve, doth every Moment endeavour by the Centrifugal Force, to get off from a Point which is the Centre of the Ark of an infinitely ſmall Circle then deſcribed. And this Endeavour is ſo much the greater, by how much the Ark of the infinitely ſmall Circle is the Portion of a leſſer Circle ; ſo that in one and the ſame Curve, the *Centrifugal Force* of the revolving Body may vary according to the different Points of the Curve in which it may at any time be. It may be therefore, that in a Curve, where the Force of Gravity in the deſcribing Body is continually variable, the *Centrifugal Force* may alſo continually vary in the ſame manner ; and ſo, that one may alſo ſupply the Defect, or abate for the Exceſs of the other, and conſequently the Effect be every where equal to the abſolute Gravity of the revolving Body. And this, as a Problem (*viz. To find ſuch a Curve in a Vertical Plane*) hath been propoſed by Mr. *Bernoulli* of *Groningen*. *Vid. Hiſt. de l'Academ. Royal*, p. 80. for the Year 1700.

CENTRIPETAL *Force* is that Force by which any Body moving round another is drawn down, or tends towards the Centre of its Orbit, and is much the ſame with Gravity. See *Vis Centripeta*.

If a Body, being ſpecifically heavier than any Medium, ſinks in it, the Exceſs of that Body's Gravity above the Gravity of the Medium, is the *Centripetal Force* of the Body downwards.

CENTROBARICAL is what relates to the *Centre of Gravity.*

CENTROBARICAL *Method of Guldinus* [in *Mechanicks*] is a Method of meaſuring or determining the Quantity of a Surface, or a Solid, by means of its *Centre of Gravity.*

CENTRUM *Phonicum.* See *Echo.*

CENTRUM *Phonacampticum.* See *Echo.*

CENTRUM *Tendinoſum* [*Anatomy*] a Point or Centre wherein the Tails of the Muſcles of the Diaphragm meet. This Centre is perforated towards the Right-ſide for the *Vena Cava*, for the Left backwards: The fleſhy Part of it gives way to the *Gula*: The deſcending Trunk of the great Artery, the *Thoracick Duct*, and *Azygos Vena*, paſs between its two inferior Proceſſes. *L.*

CENTRY-BOX, the ſame with the *Gueritte*, only the former is of Wood, and the latter of Stone. It is made to ſave the *Centry* from Injuries of Weather. In a Fortification, they are uſually placed on the Flank'd Angles of the Baſtions, on thoſe of the Shoulder, and ſometimes in the Middle of the Curtin.

CEPHALÆA [of Κεφαλὴ, *Gr.* the Head] an old obſtinate Head-ach.

CEPHALALGIA [Κεφαλαλγία, of Κεφαλὴ and ἀλγὴ, *Gr.* Pain] ſignifies, in general, any Pain of the Head, but is more eſpecially taken for a new Head-ach.

CEPHALALGICA [Κεφαλαλγία, *Gr.*] are Medicines which purge the Head. *Blanchard.*

CEPHALICA [of Κεφαλικὴ, *Gr.*] a Vein which creeps along the Arm, between the Skin and the Muſcles. It divides into two Branches: The External Branch goes down to the Wriſt, where it joins the *Baſilica*, and turns up the Back of the Hand, where it gives a Branch which makes the *Salvatella* between the Ring-finger and the Little-finger. The Ancients uſed to open this Vein in Diſeaſes of the Head; but ſince the Knowledge of the Circulation of the Blood, there is no Difference whether one be blooded in the *Cephalica*, *Mediana*, or *Baſilica*.

CEPHALICK *Medicines* are ſpirituous and volatile ones, uſed in Diſtempers of the Head. Alſo the outermoſt Vein in the Arm is called *Cephalica*, becauſe it uſed formerly to be opened, in Diſeaſes of the Head, rather than any other.

CEPHALOPHARYNGÆI [of Κεφαλὴ and φάρυγξ, *Gr.* the *Throat*] ſignifies the firſt Pair of Muſcles of the Upper-part of the Gullet, which proceed from beſide the Head and Neck, and are ſpread more largely upon the Tunick of the Gullet. *Blanchard.*

CEPHALOPHARYNGÆUM is a Muſcle that ariſeth from that Part where the Head is joined to the firſt Vertebra of the Neck; from thence marching down, it is ſpread about the *Pharynx* with a large *Plexus* of Fibres, and ſeemeth to make its Membrane. This ſtreightens the Throat in ſwallowing.

CEPHALOPONIA [of Κεφαλὴ and πόνος, *Gr.* *Pain*] is a Pain or Heavineſs in the Head.

CEPHEUS [in *Aſtronomy*] a Conſtellation of the Northern Hemiſphere.

The Stars in the Conſtellation *Cepheus*, in *Ptolemy*'s Catalogue, are 13; in *Tycho*'s 11; and in the *Britannick*, 35.

CEPI *Corpus* [in the *Common-Law*] a Return made by the Sheriff, that upon a *Capias Exigent*, or other Proceſs, he hath taken the Body of the Party.

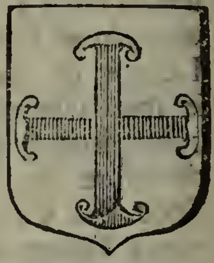
CERATIAS [Κερατίας, *Gr.*] according to ſome Writers, is a Horned Comet, ſometimes appearing Bearded, and ſometimes with a Tail or Train. Some Comets of this kind they will have to reſemble the Figure of a New-Moon; others that are tailed, have a crooked Tail, bending either upward or downward; and others have their Tail of an equal Breadth or Thickneſs.

CERATION [in *Chymiſtry*] the Preparation of any Matter, to render it fit or diſpoſed to liquefy or melt, which of itſelf it was not.

CERATODES, the ſame with *Cornea Tunica.*

CERATOGLOSSUM [of Κέρατος, *Gen.* of Κέρας, a *Horn*, and γλῶσσα, *Gr.* the *Tongue*] is the proper Pair of Muſcles belonging to the Tongue, proceeding from the Horns of the Bone called *Hyoides*, and joined to the Sides of the Tongue: Their Uſe is, to move or draw the Tongue ſtraight into the Mouth, when they act jointly; but, if either the one or the other be contracted ſingly, they move it to the Right or Left-ſide.

CERATUM, or *Cerecloth*, is a Medicine applied outwardly, made of Wax, Oyls, and ſometimes Duſt intermixed, thicker than an Ointment, and ſofter than a Plaiſter. *L.*



CERCELE [in *Heraldry*] is a Croſs which, opening at the Ends, turns round both Ways like a Ram's Horn, as in the Figure annex'd.

CERCHNOS [Κέρχνος, *Gr.*] is a certain *Aſperity* of the *Larynx*, which, to touch, feels like a Collection of Juniper-berries, whence proceeds a little dry Cough. *Blanchard.*

CERCIS [Κερκίς, *Gr.*] is the ſecond Bone of the Cubit, called *Radius*, becauſe 'tis like the Spoke of a Wheel. *Blanchard.*

CERCOSIS [of Κέρκωσις of Κέρκος, *Gr.* a *Tail*] a fleſhy Excreſcence out of the Womb, ſometimes reſembling a Tail.

CEREA [probably of Κέρας, *Gr.* a *Horn*] are the Horns of the Womb in Brutes, wherein the *Fœtus* is uſually formed. *L.*

CEREBELLUM is the Hinder-part of the Brain, conſiſting, like the Brain itſelf, of an Aſhy or Barkiſh Subſtance, and a white Marrowy one, wherein the Animal Spirits, which perform involuntary and mere natural Actions, are ſuppoſed to be generated in Man; but not ſo in Beaſts. It ſeems to conſiſt of a great many thin Plates that lie upon one another. *L.*

CEREBRUM [the *Brain*] is ſtrictly taken for the foremoſt Part of the Subſtance which is within the Skull; and it is a Subſtance of a Sort peculiar to itſelf. Outwardly it is covered with the Skin called *Pia Mater.* It is wrought with many Turnings and Windings. Its exterior Subſtance is Aſhy, wherein the Animal Spirits are thought to be generated. The interior is white, which receives the Animal Spirits from the former, and diſcharges them, by the *Corpus Calloſum* and the *Medulla Oblongata*, into the Nerves, upon which voluntary Actions do chiefly depend. Likewiſe, the Brain is the Subject of Imagination, Judgment, Memory, and Reminiſcence; for the Ideas or Species of Things being received from the Organs of the external Senſes, are carried to the common Senſory, or the Beginning of the *Medulla Oblongata*, and then by the *Corpora Striata*, and the *Corpus Calloſum*, there the Judgment and Imagination are probably formed; but the Seat of the Memory is ſaid to be in the cortical Part of the Brain; and if the Idea's, after ſome time, chance to be called for out of the Place of the Memory, then it is properly ſaid to be *Reminiſcence*, or Remembring. Sleep is likewiſe tranſacted in the Brain; concerning which ſee in its proper Place. *Blanchard.* See *Brain.*

CERT *Money* (*quaſi Certa Moneta*) was the *Head-Money*, or common Fine, paid by the Reſiants and Tenants of ſeveral Manors to their Lords. In ſome Ancient Records this is called, *Certum Letæ.*

CERTIFICATE [in *Law*] is uſed for a Writeing made in any Court, to give Notice to another Court of any thing done therein.

CERTIFICATION *of Aſſize of Novel Diſſeiſin, &c.* is a Writ granted for the re-examining, or Review of a Matter paſſed by Aſſize before any Juſtices, and is called, *Certification of new Diſcoveries.*

CERTIFICANDO *de Recognitione Stapulæ*, is a Writ directed to the Mayor of the Staple, *&c.* commanding him to certify the Chancellor of a Statute of the Staple, taken before between ſuch and ſuch, in Caſe where the Party himſelf detaineth it, and refuſeth to bring it in. *L.*

CERTIORARI is a Writ out of the *Chancery* to an inferior Court, to call up the Records of a Cauſe therein depending, that conſcionable Juſtice may be therein adminiſtred, upon Complaint made by Bill, that the Party which ſeeketh the ſaid Writ hath received hard Dealing in the ſaid Court.

CERVICAL, or *Vertebral Veſſels*, are the Arteries and Veins that paſs thro' the *Vertebræ* and Muſcles of the Neck up to the Skull.

CERVICALIS *Vena*. See *Vertebralis.*

CERVICAL *Nerves* [*Anatomy*] are ſeven Pair of Nerves ſo called, as having their Origin in the *Cervix*, or Neck; the firſt ariſes from the firſt and ſecond Vertebræ of the Neck, and contrary to the Neck, come out before and behind; whereas the other ſix Pair come out laterally from the Jointures of the *Vertebræ*, thro' particular Perforations: The firſt Pair goes to the Muſcles of the Head and Ear; the ſecond, according to Dr. *Willis*, contributes the main Branch towards the Formation of the *Diaphragmatick Nerves*, which, according to *Vieuſeus*, ſpring only from the fourth and ſixth Pair; the three laſt Pairs joining with the two firſt of the *Dorſum* or *Thorax*, make the *Brachial Nerves*. All the *Cervical Nerves* ſend innumerable Branches to the Muſcles and other Parts of the Head, Neck, and Shoulders.

CERVICALES *Deſcendentes* [*Anatomy*] Antagoniſts to the *Sacro-Lumbares*, coming from the 3d, 4th, 5th, and 6th *Vertebræ* of the Neck. *L.*

CERVIX [in *Anatomy*] the Hind-part of the Neck, the Fore-part being diſtinguiſhed by the Name of *Collum.*

CERUMINA is the Filth or Wax of the Ear, which ſeems to be ſweat out from the Cartilages: Others think it comes from the Glandules which border upon the Ears. It ſerves to hinder Duſt, Motes, or little Animals, from getting into the Ear. *L.*

CERUSS, or *White-Lead*, is Lead turned into a white Form, by the Means of the Smoak or Vapours of boiling Vinegar.

In *Philoſoph. Tranſact.* N. 137. there is this Account of the way of making *Ceruſs*: Pigs of clean and ſoft Lead are caſt into thin Plates, a Yard long and ſix Inches broad; theſe are rolled round ſo as the Surfaces no where meet to touch; for where they do, no *Ceruſs* grows. Each of theſe is put into a Pot juſt capable of holding one, and upheld by a little Bar from the Bottom, that it come not to touch the Vinegar which is put into each Pot, to effect the Converſion. Twenty of theſe a-Breaſt are put into a ſquare Bed of new Horſe-Dung, and each Pot is covered with a Plate of Lead, and then over that, with Boards as cloſe as can well be. This repeated four times, makes one *Heap*, as 'tis called, containing 1600 Pots.

After three Weeks, the Pots are taken up, the Plates unrolled, laid on Boards, and beaten with a Battledore, till all the Flakes come off, which, if good, are thick, hard, and weighty. Theſe Flakes are ground with Water between Milſtones, to almoſt an impalpable Fineneſs; after which, 'tis moulded into ſeveral Parcels, and expoſed to the Sun to dry, till it become hard and fit for Uſe.

'Tis obſerved, that ſome Pots will yield thick and good Flakes, while others alike ordered and ſet by them, without any poſſible Diſtinction of Diſadvantage, yield few, ſmall, or none at all. Sometimes the Pots are taken up all dry, and ſometimes they prove beſt; ſometimes they are taken up wet. The Plates that cover the Pots yield better and thicker Flakes than do the Rolls within; and the Outſides next to the Planks bigger and better than the Inſides next to the Rolls, and to the Spirits which firſt riſe from the Vinegar.

CESSAVIT is a Writ that lieth upon this general Ground, that he againſt whom it is brought hath neglected to pay ſuch Rents, or to perform ſuch Service as he is tied to by his Tenure, and hath not, upon his Land or Tenement, ſufficient Goods or Chattels to be diſtrained. *L.*

CESSION is one manner of an Eccleſiaſtical Benefice's becoming void. By the Canon-Law, if a Clerk have one Living, tho' under 8 Pounds *per Annum* Value, and takes a Second of what Value ſoever, the former is void without a Diſpenſation; that is, 'tis void *de jure, ſed non de facto.* But, by Statute, if a Clerk have one Benefice of 8 Pounds *per Annum*, or upwards, and takes another of any Value whatſoever, with Cure of Souls, and without Diſpenſation, the former Living is *ipſo facto* void; and this kind of Voidance of a Living is called *Ceſſion.* And what is called *Ceſſion* in other Benefices, is called *Creation* in relation to a Biſhoprick; for if an Incumbent be made a Biſhop, his Benefice is ſaid to be void by *Creation.*

CESSION [in the *Civil-Law*] is putting another Perſon, who therefore is called the

CESSIONARY, into the Place and Right of the true and proper Creditor in any Caſe. This is alſo called *Subrogation.*

CESSOR [in *Law*] is one that ceaſeth or neglecteth ſo long to perform ſome Duty belonging to him, as that by this his *Ceſſe*, or *Ceaſing*, he incurs the Danger of the Law, and hath, or may have, the Writ *Ceſſavit* brought againſt him. And where it is ſaid in their Terms, the Tenant *Ceſſeth* without any more Words, it is to be underſtood, the Tenant ceaſeth to do by his Lands or Tenement.

CESTUI *qui Truſt* [in *Law*] is he who has Lands in Truſt, *&c.* committed to him, for the Benefit of another. *F.*

CESTUI *qui Vie* [in *Law*] one for whoſe Life any Lands or Tenements are granted. *F.*

CESTUI *qui Uſe* [in *Law*] he to whoſe Uſe another Man is infeoffed in Lands or Tenements. *F.*

CETUS [in *Aſtronomy*] the *Whale*, a Conſtellation of the Southern Hemiſphere.

The Stars in the Conſtellation *Cetus*, in *Ptolemy*'s Catalogue, are 22; in *Tycho*'s, 21; in the *Britannick*, 78.

CHACE *Guns* [of a *Ship*] are ſuch whoſe Ports are either in the Head, and then they are uſed in chaſing of others; or elſe they are in the Stern, and are uſed only when they are chaſed or purſued by others.

CHACONNE [in *Muſick*] is a kind of *Saraband*, whoſe Meaſure is always Triple-time.

CHAFE. Seamen ſay a Rope chafes, when it galls or frets by rubbing againſt any rough and hard thing: Thus they ſay, *The Cable is chafed in the Hawſe*, when it is fretted, or begun to be worn out there.

CHAFERY is the Term for one of the Forges in an Iron-work (ſee *Iron*). The other is called the *Finery*.

CHAFE-WAX is an Officer belonging to the Lord High Chancellor, who fits the Wax for the Sealing of Writs, and ſuch other Inſtruments as are by his Order made to be ſent out.

CHAIN is an Inſtrument uſed in *Surveying*, to meaſure Land withal; of which there are ſeveral Sorts; as,

1. A *Chain* of 100 Foot long, each Link being one Foot in Length; and at each 10 Foot there is a Plate of Braſs, with a Figure engraven thereon, to ſhew readily how many Feet are from the Beginning of the Chain: And for more Eaſe in accounting, there is (or ſhould be) a Braſs Ring at every five Links; that is, one between every two Plates.

This Chain is moſt commodious for meaſuring of large Diſtances or Lengths.

2. A *Chain* of 16 Foot and a Half in Length, and made ſo as to contain 100 Links, with Rings at every 10th Link.

This Chain will be good to meaſure ſmall Garden-Grounds, or Orchards, by Perch or Pole Meaſure.

3. A *Chain* of Four Poles, or Perches, in Length, which is 66 Foot, or 22 Yards; for each Perch contains 16 Foot and a Half. This whole Chain is divided into 100 equal Parts, or Links, whereof 25 are a juſt Pole, or Perch; and for ready accounting, there is uſually a remarkable Diſtinction, by ſome Plate or large Ring, at the End of every 25 Links: Alſo, at the End of every 10th Link, 'tis uſual to faſten a Plate of Braſs, with Notches therein, denoting how many Links are from the Beginning of the Chain.

This Chain, of all others, is the moſt commodious for Land-Meaſure.

When you are to meaſure any Line by the *Chain*, you need to regard no other Denomination but only *Chains* and *Links* ſet down with a Prick of your Pen betwixt them: Thus if you find the Side of the *Cloſe* to be 6 *Chains* and 35 *Links* long, it muſt be put down thus: 6. 35.

But if the Links be under 10, a Cypher muſt be prefixed; ſo 7 *Chains* and 9 *Links* muſt be thus ſet: 7. 09.

How to caſt up the Content of a Figure, the Lines being given in Chains *and* Links.

Having multiplied Length by Breadth, or Baſe by the Half Perpendicular, *&c.* according to the Rules for finding the Content of Figures, under the Word *Area.*

RULE I.

From the Product cut off 5 Figures towards the Right-hand, with a Daſh of your Pen, ſo ſhall thoſe to the Left-hand again ſignify *Acres.*

RULE II.

If theſe Five cut off to the Right-hand were not all Cyphers, multiply them by 4; and cutting off 5 Figures toward the Right-hand again, the reſt will be *Roods* or *Quarters.*

RULE III.

Alſo, if amongſt theſe five Figures cut off at the ſecond Multiplication, there be any Figures beſides Cyphers, then multiply all the Five by 40, cutting off Five again with a Daſh, and thoſe on the Left-hand ſignify *Square Perches* or *Poles*: As for Inſtance:

Having a *Square Field* given, whoſe Sides are each of them, 7 *Chains*, 25 *Links*, the Content of this *Square* is required in *Acres*, *Roods*, and *Perches.*

Length 7. 25
Breadth 7. 25

3625
1450
5075

Acres 525625
4

Rood 1 | 02500
4

Perch 2 | 00000

Anſw. 5 *Acres*, 1 *Rood*, and 1 *Perch.*

The Reaſon of this Practical Rule is plain, if you conſider that 5 Chains (or 20 Perches) in Length, and 2 Chains (or 8 Perches) in Breadth, make an Acre (or 160 Square Perches); Alſo, 5 Chains multiplied by 2, is the ſame with 500 Links by 200, which makes 100000 Square Links.

Wherefore 'tis evident, that 525625 Square Links (*i. e.* the Product of 7. 25 by 7.25) divided by 100000; that is, by cutting off five Figures on the Right-hand, leaves 5 Acres, and 25625 Square Links over.

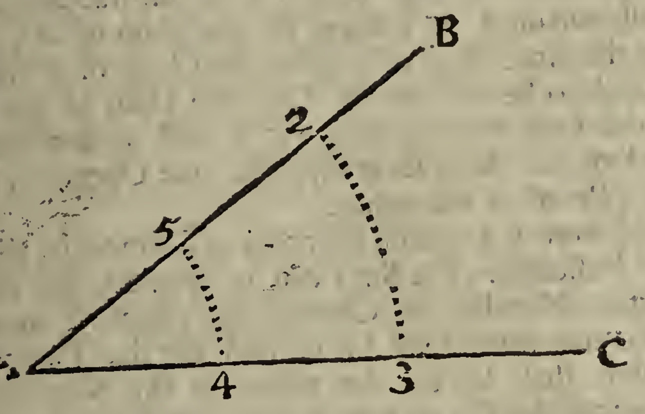
Alſo, if 25625 Square Links do contain any Quarter or Quarters of an Acre, then it is but multiplying by 4, and dividing by 100000, (*i e.* Five cut off from the Products) they will contain ſo many Acres as now they do Quarters or Roods; for any Number of Quarters multiplied by 4, produce the like Number of Integers, and only Diviſion reduces them to the right Denomination: So that 25625 multiplied by 4, gives 1 | 02500, which divided by 100000, leaves 1 Acre and 2500 Quarters of Square Links over.

This laſt Remainder 2500 (being the true Number of Square Links multiplied by 4) if multiplied by 40 (which is ¼ of 160) it muſt as often contain 100000 Square Links, as the ¼ of 2500, *i. e* 625, containeth the Square Perches.

Thus 100000 divided by 160, gives 625, as anſwering to 1 Perch: Alſo 2500 multiplied by 40, gives 100000, or 1 Acre (after Diviſion) or five Figures cut off.

How by the Chain *to take an* Angle *in the Field.*

Firſt, Meaſure along the Hedge A B any ſmall Diſtance, as A 2, two Chains: Alſo meaſure along the Hedge A C what Number of Chains you pleaſe, no matter whether they be equal to the former or not, as A 3, two Chains; then meaſure the Diſtance, 2, 3; ſuppoſe it be 1 Chain, 68 Links.



To plot which, draw the Line A B at Pleaſure, and ſet off 2 Chains from A to 2; then take in your Compaſſes the Diſtance of A 3, 2 Chains, ſetting one Foot in A, deſcribe the Arch 2, 3: take alſo in your Compaſſes, 1 Chain, 68 Links, ſet it from 2 to 3, and thro' the Point 3 draw A C; ſo you have the Angle B A C of the Field truly plotted.

The ſame may be otherwiſe performed, thus:

Set a Stick in the Angle, and putting the Ring at one End of the Chain over it, take the other End in your Hand, and ſtretch out the Chain along the Hedge A B, and where it ends at 5, ſet a Stick; then ſtretch the Chain along the Hedge A C, and at the End thereof ſet another Stick, as at 4, then let looſe the Chain from A, and meaſure the Diſtance 5, 4, which ſuppoſe 74 Links, then plot it as before.

By this Means you may ſurvey a Field by going round the ſame with the Chain only, by taking all the Angles, and meaſuring the Sides. The ſame may be plotted by Direction given under the Word *Surveying*.

CHAIN-SHOT is two Bullets, or rather Half Bullets, with a Chain between them; their Uſe is (at Sea) to ſhoot down Yards and Maſts, or cut the Shrouds, or any Rigging of a Ship.

CHAIN-WALES [in a *Ship*] are the broad Timbers which are made jutting out of her Sides, to which, with Chains, the Shrouds are faſtened, and by them ſpread out, the better to ſupport the Maſts.

CHAINS [in a *Ship*] are thoſe Irons to which the Shrouds of the Maſts are made faſt to the Chain-Wales at the Ship's Sides.

CHALASTICK *Medicines* [Χαλαστικὰ of Χαλάινω, *Gr.* to *render lax*] are ſuch as by their temperate and moderate Heat, do comfort and ſtrengthen the Parts to which they are applied.

CHALAZA [of Χάλαζα *Gr.* a *Hail-ſtone*] the Treadle of an Egg; every Egg has two of them, one in the obtuſe, and the other in the acute End. There is more of them in the White; yea they ſtick cloſer to the Yolk, and are faſtened to its Membrane. They are ſomething long Bodies, more concrete than the White, and whiter, knotty, have ſome ſort of Light, as Hail, whence they have their Name; for each *Chalaza* conſiſts, as it were, of ſo many Hail-ſtones ſeparated from each other by that White: One of them is bigger than the other, and further from the Yolk; is extended towards the obtuſe End of the Egg: The other is leſs, and extends itſelf from the Yolk towards the acute End of the Egg. The Greater is made up of two or three Knots, like ſo many Hail-ſtones, which are moderately diſtant from each other, the leſs in order to ſucceed the Greater.

It is alſo a Diſeaſe incident to Swine. *Blanchard.*

CHALAZION [Χαλάζιον, *Gr.*] is a little Swelling in the Eye-lids, like a little Hail-ſtone.

CHALCANTHUM *Rubefactum*, is only Vitriol calcined to Redneſs.

CHALCOGRAPHY is the Art of Engraving, Sculpture, *&c.*

CHALLENGE [in *Common-Law*] ſignifies an Exception againſt Perſons or Things; as, a Priſoner may except againſt the partial impannelling of a Jury, or againſt the Inſufficiency of the Jurors.

CHALOUP. See *Shallop.*

CHALYBEAT [of Χάλυψ, *Gr.* Steel] is that which partakes of the Nature of Steel: Thus *Chalybeat Medicines* are a Preparation of Steel or Iron, or a Compoſition in which Steel or Iron is an Ingredient.

CHALYBEAT *Cryſtals of Tartar.* See *Cream of Tartar.*

CHAMADE is a Signal made by the Enemy, either by Beat of Drum or Sound of Trumpet, when they have any Matter to propound; as, when they ſound, or beat a *Parley*.

CHAMBER. That Part of the Cavity of a great Gun where her Charge lies, is called the *Chamber*. Theſe Pieces which at Sea they call *Murtherers*, have Chambers which are put in at their Breeches.

CHAMBERLAIN [from the *French*, *Chambelan*; i. e. *Cubicularius vel Præfectus Cubiculi*] is uſed in divers Senſes in our Chronicles, and old Books of Laws and Statutes; as, the Lord Great *Chamberlain* of *England*, Lord *Chamberlain* of the *King's Houſe*, the King's *Chamberlain*, 13 *E.* I. *c.* 41. 17 *R.* II. *c.* 16. to whoſe Office it appertaineth to look to the King's Chambers and Wardrobe, and to govern the Under-Servants and Officers there. There is alſo a *Chamberlain* of any of the King's Courts; as, *Chamberlain* of the *Exchequer*, 51 *H.* III. *Stat.* 5. 13 *Ed.* III. 14. 26 *H.* VII. 2. There is a *Chamberlain* of *North Wales*, of *Cheſter*, of the City of *London*. This Officer is commonly the Receiver of all Rents and Revenues belonging to the *City* whereof he is *Chamberlain*. When there is no Prince of *Wales* and Earl of *Cheſter*, the *Chamberlain* of *Cheſter* hath the Receipt and Return of all Writs coming thither out of any of the King's Courts.

In the *Exchequer* there be two Officers of this Name, who were wont to keep a *Controlment* of the *Pells* of *Receipts* and *Exitus*, and kept certain Keys of the Treaſury and Records. They kept alſo the Keys of that Treaſury where the Leagues of the King's Predeceſſors, and divers ancient Books; as, *Dooms-day Book*, and the *Black-Book* of the *Exchequer*, remain.

CHAMBRANLE, an Ornament, in *Maſonry* and *Joyner's-Work*, bordering the three Sides of Doors, Windows, and Chimneys. It is different, according to the ſeveral Orders, and conſiſting of three Parts; *viz.* the Top, called the *Traverſe*, and the two Sides, the *Aſcendants*.

CHAMFER, CHAMFRET [in *Architecture*] is an Ornament conſiſting of Half a *Scotia*, being a kind of ſmall Furrow or Gutter on a Column, called alſo a *Scapus*, *Stria*, *&c.*

CHAMFERING, CHAMFRAINING [in *Architecture*] is a Term uſed for the cutting the Edge or End of any thing aſlope or bevil.

CHAMPARTORS, ſuch as practiſe *Champartry*.

CHAMPARTRY [in *Common-Law*] ſignifies a Maintenance of any Man in his Suit depending, upon Condition to have Part of the Things (be it Lands or Goods) when recovered.

CHAMPION [in the *Common-Law*] is uſed no leſs for him that trieth a Combat in his own Cauſe, than for him that fighteth in the Quarrel or Place of another; and, according to *Bracton*, and ſome others, it is uſed for one that holdeth by *Serjeantry*, or ſome ſuch Service, of another. There is alſo an Officer now called

CHAMPION *of the King*, who is at a Coronation, while the King is at Dinner, to ride armed, *Cap-a-pee*, into *Weſtminſter-Hall*, and, by a Herald, make a Challenge, That if any Perſon ſhall deny the King's Title to the Crown, he is there by ready to defend it: Which done, the King drinks to him, and ſends him a Gilt Cup with a Cover, full of Wine, which he hath for his Fee.

CHANCE is the Probability of an Event, and is greater, or leſs, according to the Number of Chances by which it may happen, compared with the Number of all the Chances, by which it may either happen or fail;

Thus: If an Event has 3 Chances to happen and 2 to fail, the Probability of its happening may be eſtimated to be $\frac{3}{5}$, and the Probability of its failing $\frac{2}{5}$.

Therefore, if the Probability of Happening or Failing are added together, the Sum will always be equal to Unity.

If the Probabilities of Happening or Failing are unequal, there is what is commonly called Odds for, or againſt, the Happening or Failing; which Odds are proportional to the Number of Chances for Happening or Failing.

The Expectation of obtaining any thing, is eſtimated by the Value of that Thing, multiplied by the Probability of obtaining it;

Thus: Suppoſing that *A* and *B* play together; that *A* has depoſited 5 Pounds, and *B* 3 Pounds; that the Number of Chances which *A* has to win is 4; and that the Number of Chances which *B* has to win is 2: Since the whole Sum depoſited is 8, and that the Probability which *A* has of getting it is $\frac{4}{6}$, it follows, that the Expectation of *A* upon the whole Sum depoſited, will be $\frac{8}{1} \times \frac{4}{6} = 5\frac{1}{3}$; and for the ſame Reaſon, the Expectation of *B* will be $\frac{8}{1} \times \frac{2}{6} = 2\frac{2}{3}$.

The Risk of loſing any thing, is eſtimated by the Value of that Thing, multiplied by the Probability of loſing it.

If from the reſpective Expectations which the Gameſters have upon the whole Sum depoſited, the particular Sums they depoſite (that is, their own Stakes) be ſubtracted, there will remain the Gain, if the Difference is poſitive; or the Loſs, if the Difference is negative;

Thus: If from $5\frac{1}{3}$, the Expectation of *A*, 5 (which is his own Stake) be ſubtracted, there will remain $\frac{1}{3}$ for his Gain: Likewiſe, if from $2\frac{1}{3}$, the Expectation of *B*, 3 (which is his own Stake) be ſubtracted, there will remain $-\frac{1}{3}$ for his Gain, or $\frac{1}{3}$ for his Loſs.

Again: If from the reſpective Expectations, which either Gameſter has upon the Sum depoſited by his Adverſary, the Risk of loſing what he himſelf depoſits be ſubtracted, there will likewiſe remain his Gain or Loſs;

Thus: In the preceding Caſe, the Stake of *B* being 3, and the Probability which *A* has of winning it being $\frac{4}{6}$, the Expectation of *A* upon that Stake is $\frac{3}{1} \times \frac{4}{6} = \frac{12}{6} = 2$. Moreover, the Stake of *A* being 5, and the Probability of loſing it being $\frac{2}{6}$, the Risk which *A* runs of loſing his own Stake, is $\frac{5}{1} \times \frac{2}{6} = \frac{10}{6} = 1\frac{2}{3}$: Therefore, if from the Expectation 2, the Risk $1\frac{2}{3}$ be ſubtracted, there will remain $\frac{1}{3}$, as before, for the Gain of *A*; and, by the ſame Way of arguing, the Loſs of *B* will be found to be $\frac{1}{3}$. *N. B.* Tho' the Gain of the one is the Loſs of the other, yet it will be convenient to look for them ſeverally, that one Operation may be a Proof of the other.

If there is a certain Number of Chances by which the Poſſeſſion of a Sum can be ſecured, and alſo a certain Number of Chances by which it may be loſt, that Sum may be inſured for that Part of it which ſhall be to the whole as the Number of Chances there is to loſe it is to the Number of all the Chances;

Thus: If there be 19 Chances to ſecure the Poſſeſſion of 1000 *l.* and 1 Chance to loſe it, the Inſurance Money may be found by this Proportion:

As 20 is to 1, ſo is 1000 to 50; therefore 50 is the Sum that ought to be given, in this Caſe, to inſure 1000 *l.*

If two Events have no Dependance on each other, ſo that p be the Number of Chances by which the firſt may Happen, and q the Number of Chances by which it may Fail; and likewiſe, that r be the Number of Chances by which the ſecond may Happen, and s the Number of Chances by which it may Fail: Multiply $p + q$ by $r + s$, and the Product $pr + qr + ps + qs$ will contain all the Chances by which the Happening or Failing of the Events may be varied amongſt one another.

Therefore, if *A* and *B* play together, on Condition, that if both Events happen *A* ſhall win, and *B* loſe, the Odds that *A* ſhall be the Winner, are as pr to $qr + ps + qs$; for the only Term in which both p and r occurs is pr: Therefore the Probability of *A*'s winning is $\frac{pr}{pr + qr + ps + qs}$.

But if *A* holds that either one or the other will Happen, the Odds of *A*'s winning are as $pr + qr + ps$ to qs; for ſome of the Chances that are favourable to *A*, occur in every one of the Terms pr, qr, ps.

Again: If *A* holds that the firſt will happen, and the ſecond fail, the Odds are as ps to $pr + qr + qs$.

From what has been ſaid, it follows, That if a Fraction expreſſes the Probability of an Event, and another Fraction the Probability of another Event, and thoſe two Events are independent, the Probability that both thoſe Events will happen will be the Product of thoſe two Fractions;

Thus: Suppoſe I have two Wagers depending, in the firſt of which I have 3 to 2 the beſt of the Lay, and in the ſecond 7 to 4, What is the Probability I win both Wagers?

The Probability of winning the firſt is $\frac{3}{5}$, that is the Number of Chances I have to win, divided by the Number of all the Chances; the Probability of winning the ſecond is $\frac{7}{11}$: Therefore multiplying theſe two Fractions together, the Product will be $\frac{21}{55}$, which is the Probability of winning both Wagers. Now this Fraction being ſubtracted from 1, the Remainder is $\frac{34}{55}$, which is the Probability I do not win both Wagers; therefore the Odds againſt me are 34 to 21.

2°. If I would know what the Probability is of winning the firſt and loſing the ſecond, I argue thus: The Probability of winning the firſt is $\frac{3}{5}$, the Probability of loſing the ſecond is $\frac{4}{11}$: Therefore, multiplying $\frac{3}{5}$ by $\frac{4}{11}$, the Product $\frac{12}{55}$ will be the Probability of my winning the firſt, and loſing the ſecond; which being ſubtracted from 1, there will remain $\frac{43}{55}$, which is the Probability I do not win the firſt, and at the ſame time loſe the ſecond.

3°. If I would know what the Probability is of winning the ſecond, and at the ſame time loſing the firſt, I ſay thus: The Probability of winning the ſecond is $\frac{7}{11}$; the Probability of loſing the firſt is $\frac{2}{5}$: Therefore multiplying theſe two Fractions together, the Product $\frac{14}{55}$ is the Probability I win the ſecond, and alſo loſe the firſt.

4°. If I would know what the Probability is of loſing both Wagers, I ſay, The Probability of loſing the firſt is $\frac{2}{5}$, and the Probability of loſing the ſecond $\frac{4}{11}$; therefore the Probability of loſing them both is $\frac{8}{55}$; which being ſubtracted from 1, there remains $\frac{47}{55}$: Therefore the Odds againſt loſing both Wagers is 47 to 8.

This Way of reaſoning is plain, and is of very great Extent, being applicable to the Happening or Failing of as many Events as may fall under Conſideration; thus: If I would know what the Probability is of miſſing an Ace 4 Times together with a common Die, I conſider the miſſing of the Ace 4 Times, as the Failing of 4 different Events; now the Probability of miſſing the firſt is $\frac{5}{6}$, the Probability of miſſing the ſecond is alſo $\frac{5}{6}$, the third $\frac{5}{6}$, and the fourth $\frac{5}{6}$; therefore the Probability of miſſing the Ace 4 times together is $\frac{5}{6} \times \frac{5}{6} \times \frac{5}{6} \times \frac{5}{6} = \frac{625}{1296}$; which being ſubtracted from 1, there will remain $\frac{671}{1296}$ for the Probability of throwing it once or oftner in 4 Times: Therefore the Odds of throwing an Ace in 4 Times is 671 to 625.

But if the flinging of an Ace was undertaken in 3 Times, 'tis plain, that the Probability of miſſing it 3 Times would be $\frac{5}{6} \times \frac{5}{6} \times \frac{5}{6} = \frac{125}{216}$; which being ſubtracted from 1, there will remain $\frac{91}{216}$ for the Probability of throwing it once or oftner in 3 Times: Therefore the Odds againſt throwing it in 3 Times, are 125 to 91.

Again: Suppoſe we would know the Probability of throwing an Ace once in 4 Throws, and no more: Since the Probability of throwing it the firſt Time is $\frac{1}{6}$, and the Probability of miſſing it the other 3 Times is $\frac{5}{6} \times \frac{5}{6} \times \frac{5}{6}$, it follows, that the Probability of throwing it the firſt Time, and miſſing it 3 Times ſucceſſively, is $\frac{1}{6} \times \frac{5}{6} \times \frac{5}{6} \times \frac{5}{6} = \frac{125}{1296}$; but, becauſe it is poſſible to hit it in every Throw as well as at firſt, it follows, that the Probability of throwing it once in 4 Throws, and miſſing the other 3 Times, is $\frac{4 \times 125}{1296} = \frac{500}{1296}$; which being ſubtracted from 1, there will remain $\frac{796}{1296}$ from the Probability of not throwing it once, and no more, in 4 Times: Therefore if one undertakes to throw an Ace once, and no more, in 4 Times, he has 500 to 796 the worſt of the Lay, or 5 to 8 very near.

Suppoſe two Events are ſuch, that one of them has twice as many Chances to come up as the other, What is the Probability that the Event which has the greater Number of Chances to come up does not happen twice before the other happens once, which is the Caſe of flinging 7 with two Die's before 4 once? Since the Number of Chances are as 2 to 1, the Probability of the firſt happening before the ſecond is $\frac{2}{3}$, but the Probability of its happening twice before it, is but $\frac{2}{3} \times \frac{2}{3}$ or $\frac{4}{9}$: Therefore 'tis 5 to 4 Seven does not come up twice before Four once.

But if it was demanded, What muſt be the Proportion of the Facilities of the coming up of two Events, to make that which has the moſt Chances to come up twice before the other comes up once? The Anſwer is, 12 to 5 very near (and this Proportion may be determined yet with a greater Exactneſs); for if the Proportion of Chances is 12 to 5, it follows, that the Probability of throwing the firſt before the ſecond is $\frac{12}{17}$, and the Probability of throwing it twice is $\frac{12}{17} \times \frac{12}{17}$ or $\frac{144}{289}$; therefore the Probability of not doing it is $\frac{145}{289}$: Therefore the Odds againſt are as 145 to 144, which comes very near a Proportion of Equality.

What we have ſaid hitherto concerning two or more Events, relates only to thoſe which have no Dependency on each other: As for thoſe that have a Dependency, the Manner of arguing about them will be a little altered. But to know in what the Nature of this Dependency conſiſts, I ſhall propoſe the two following eaſy Problems.

Suppoſe there is a Heap of 13 Cards of one Colour, and another Heap of 13 Cards of another Colour, What is the Probability, that taking one Card at a Venture out of each Heap, I ſhall take out the two Aces?

The Probability of taking the Ace out of the firſt Heap is $\frac{1}{13}$, the Probability of taking the Ace out of the ſecond is alſo $\frac{1}{13}$; therefore the Probability of taking out both Aces is $\frac{1}{13} \times \frac{1}{13} = \frac{1}{169}$; which being ſubtracted from 1, there will remain $\frac{168}{169}$: Therefore the Odds againſt me are 168 to 1.

But ſuppoſe, that out of one ſingle Heap of 13 Cards of one Colour, I ſhould undertake to take out, firſt the Ace, ſecondly the Two: Tho' the Probability of taking out the Ace be $\frac{1}{13}$, and the Probability of taking out the Two be likewiſe $\frac{1}{13}$, yet the Ace being ſuppoſed as taken out already, there will remain only 12 Cards in the Heap, which will make the Probability of taking out the Two to be $\frac{1}{12}$; therefore the Probability of taking out the Ace, and then the Two, will be $\frac{1}{13} \times \frac{1}{12}$: And upon this way of reaſoning may the whole Doctrine of Combinations be grounded.

'Tis plain, that in this laſt Queſtion the two Events propoſed have on each other a Dependency of Order, which Dependency conſiſts in this, That one of the Events being ſuppoſed as having happened, the Probability of the other's happening is thereby altered; whereas in the firſt Queſtion, the taking the Ace out of the firſt Heap does not alter the Probability of taking the Ace out of the ſecond: Therefore the Independency of Events conſiſts in this, That the Happening of one does not alter the Degree of Probability of the other's Happening.

We have ſeen already how to determine the Probability of the happening of as many Events as may be aſſigned, and the failing of as many others as may be aſſigned likewiſe, when thoſe Events are independent: We have ſeen alſo how to determine the happening of two Events, or as many as may be aſſigned, when they are dependent.

If the Events in queſtion are n in Number, and are ſuch as have the ſame Number a of Chances, by which they may happen, and likewiſe the ſame Number b of Chances by which they may fail, raiſe $a+b$ to the Power n.

And if *A* and *B* play together, on Condition, that if either one or more of the Events in queſtion do happen, *A* ſhall win and *B* loſe, the Probability of *A*'s winning will be $\frac{\overline{a+b}|^{n}-b^{n}}{\overline{a+b}|^{n}}$, and that of *B*'s winning will be $\frac{b^{n}}{\overline{a+b}|^{n}}$; for when $a+b$ is actually raiſed to the Power n, the only Term in which a does not occur, is the laſt b^{n}: Therefore all the Terms but the laſt are favourable to *A*.

Thus: If $n=3$, raiſing $a+b$ to the Cube $a^{3}+3a^{2}b+3ab^{2}+b^{3}$, all the Terms but b^{3} will be favourable to *A*; and therefore the Probability of *A*'s winning will be $\frac{a^{3}+3a^{2}b+3ab^{2}}{\overline{a+b}|^{3}}$ or $\frac{\overline{a+b}|^{3}-b^{3}}{\overline{a+b}|^{3}}$, and the Probability of *B*'s winning will be $\frac{b^{3}}{\overline{a+b}|^{3}}$.

But if *A* and *B* play, on Condition, that if either two or more of the Events in queſtion do happen, *A* ſhall win; but in caſe one only happens, or none, *B* ſhall win, the Probability of *A*'s winning will be $\frac{\overline{a+b}|^{n}-nab^{n-1}-b^{n}}{\overline{a+b}|^{n}}$; for the only two Terms in which aa does not occur, are the two laſt, *viz.* nab^{n-1} and b^{n}; and ſo of the reſt.

CHANCEL [ſo called of *Cancellum*, which, in the lower *Latin*, is uſed in the ſame Senſe, from *Cancell*'s Latices, or Croſs-Bars, wherewith the Chancels were anciently encompaſſed, as they are now with Rails] a Part of the Choir of a Church, between the Altar or Communion-Table and the Baluſtrade or Rails that incloſe it, where the Miniſter is placed, at the Celebration of the Communion.

CHANCELLOR is a Title given, in our Kingdom, to him that is the *Chief Man* for Matter of Juſtice (in private Caſes eſpecially) next to the Prince: For whereas all other Juſtices are tied by the Law, and may not ſwerve from it in Judgement, the Chancellor hath, in this, the King's abſolute Power to moderate and temper the written Law, ſubjecting himſelf only to the Law of Nature and Conſcience, and ordering all things *juxta Æquum & Bonum*: And therefore *Stamford*, in his *Prerogative*, *c.* 20. *p.* 65. ſaith, That the *Chancellor* hath two Powers, one *Abſolute*, and the other *Ordinary*, meaning, that tho' by his ordinary Power, in ſome Caſes, he muſt obſerve the Form of Proceeding as the other Ordinary Judges do; yet, that in his abſolute Power he is not limited by the written Law, but by Conſcience and Equity, according to the Circumſtances of the Matter in queſtion.

This high Officer now bears the Title of *Lord High Chancellor* of *Great Britain*. But there are others that bear this Name of *Chancellor*; as, the

CHANCELLOR *of the Exchequer*, who ſits in the *Court* and *Exchequer-Chamber*, and, with the reſt of the Court, ordereth things to the King's beſt Benefit. He is always in Commiſſion with the Lord Treaſurer for the letting of Crown Lands, *&c.* and hath, by the Privy Seal from the King, Power with others, to compound for Forfeitures of Bonds upon penal Statutes; and his Power extends to the Firſt-Fruits Office, *&c.*

CHANCELLOR *of the Dutchy of* Lancaſter, is an Officer in that Court principally to judge and determine all Controverſies between the King and his Tenants about the *Dutchy-Land*, and otherwiſe to direct all the King's Affairs belonging to that Court.

CHANCERY is a Court of Equity and Conſcience, moderating the Rigors of other Courts, and is not tied ſtrictly to the Letter of the Law. The Officers in it are: The Lord *Chancellor*, or *Keeper* of the *Great Seal*; Twelve *Maſters* of *Chancery*, whereof ſome are always ſitting in their Turn on the Bench, as *Aſſiſtants*; the Six *Clerks*, who have under them about 90 Clerks, in the Nature of Attorneys in the Court; two *Chief Examiners*, who have each of them ſeveral Clerks; one *Chief Regiſter*, who uſually hath four or five Deputies; the *Clerk* of the *Crown*; the *Warden* of the *Fleet*, the *Uſher*, *Serjeant at Arms*, and *Cryer* of the *Court*; the *Curſitors* and their *Clerks* of the *Petty Bag*; the *Clerk* of the *Appeals*, of the *Faculties*, *Patents*, *Preſentations*, *Diſmiſſion*, *Licences* to alienate, *Injunctions*, *Enrollments*, *Protections*, *Subpænas*, and of the *Affidavits*, &c. the *Sealer*, *Chafe-Wax*, &c.

CHANCE-MEDLEY [in *Law*] ſignifies the caſual killing of a Man, not altogether without the Killer's Fault, tho' without an evil Intent.

CHANDELIERS [in *Fortification*] are Wooden Parapets made of two upright Stakes ſix Foot high, which ſupport divers Planks laid acroſs one another, or Bavins filled with Earth. They are made uſe of in Approaches, Galleries, and Mines, to cover the Workmen, and to hinder the Beſieged from forcing them to quit their Labours. The only Difference between *Chandeliers* and *Blinds* is, that the former ſerve to cover the Pioneers before, and the latter to cover them over-Head.

CHANEL [in the *Ionick Capital*] is a Part which is ſomewhat hollow under the *Abacus*, after the *Liſtel*, and lies upon the *Echinus*, having its Contours or Turnings on each Side, to make the *Voluta's*.

CHANGES [in *Arithmetick*, &c.] the Permutations, or Variations, of any Number of Quantities, with regard to their Poſition, Order, *&c.* See *Combination.*

CHAOS [of Χάος, *Gr.*] The ancient *Ethnick* Philoſophers ſuppoſe the World to be formed at firſt out of a *Chaos*; that is, a dark kind of turbulent Atmoſphere, or a diſorderly Syſtem of Mixture of all ſorts of Particles together, without any Regularity in any Reſpect. This the *Greeks* called Πνοὴ ἀέρος ζοφώδης, and the *Latins*, *Rudis Indigeſtaque Moles* ——. It is probable enough that the Notion came from *Moſes*, who ſays, *The Earth was without Form, and void, and that Darkneſs was upon the Face of the Abyſs*; tho' he gives no farther Deſcription of it, nor tells us whence it took its Original, and came into ſuch a confuſed State.

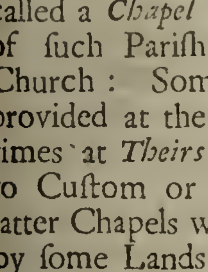
Mr. *Whiſton*, in his late *New Theory of the Earth*, ſuppoſes the ancient *Chaos*, the *Origin* of our Earth, to have been the Atmoſphere of a Comet: Which new, tho' indeed, all things conſidered, not improbable Aſſertion, he endeavours to make out by many Arguments, drawn from the Agreement which appears to be between them (ſee his *Theory*, *p.* 69.) ſo that, according to him, every *Planet* is a *Comet* formed into a regular and laſting Conſtitution, and placed at a proper Diſtance from the *Sun*, revolving in a nearly circular Orbit: And a *Comet* is a *Planet* either beginning to be deſtroyed or re-made, that is, a *Chaos*, or a *Planet unformed*, in its Primeval State, and placed as yet in an Orbit very excentrical.

CHAPEAU [in *Heraldry*] is a Cap of Dignity uſed to be worn by Dukes; 'tis of a Scarlet Colour, lined with Ermines, and on it, as on a Wreath, the Creſt of Noblemens Coats of Arms is born, and by it parted from the Helmet, which no Creſt muſt touch immediately. *F.*

CHAPEL is of two ſorts; either adjoining to a Church, as a Parcel of the ſame which Men of Worth hold, *ut ibidem Familiaria Sepulchra ſibi conſtituant*; or elſe *ſeparate* from the Mother Church, where the Pariſh is wide; and is uſually called a *Chapel of Eaſe*, becauſe built for the Eaſe of ſuch Pariſhioners as dwell too far from the Church: Sometimes this is ſerved by a Curate provided at the Charge of the Rector, and ſometimes at *Theirs* that have Benefit by it, according to Cuſtom or Compoſition. And ſome of theſe latter Chapels which have a Maintenance perpetual by ſome Lands charitably beſtowed on them, or otherwiſe, without the Charge of the Rector of the Church, are called *Free Chapels:*

CHAPERON, CHAFFEROON, properly ſignifies a ſort of Hood or Covering for the Head, anciently worn by Men and Women, the Nobles and the Populace, and afterwards particularly affected to the Doctors and Licentiates of Colleges, *&c.*

Hence the Name was transferred to little Shields containing Deaths Heads, and other Funeral Devices, placed on the Foreheads of the Horſes which drew the Hearſes at Pompous Funerals, ſo called, becauſe theſe Devices were anciently faſtened to the *Chaperonnes*, or Hoods, that thoſe Horſes uſed to wear with their other Coverings of State.

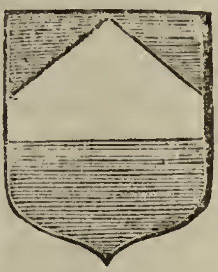


CHAPERONNE [in *Heraldry*] ſignifies hooded with ſuch Hoods as above deſcribed, or ſuch as Finers wear, with as much hanging down as covered the Shoulders and Part of the Arms cloſed every Way, as in the Figure annexed.

CHAPITERS [in *Law*] ſignifies a Summary or Content of ſuch Matters as are to be enquired of, or preſented before Juſtices in Eyre, Juſtices of Aſſize, or of Peace, in their Seſſions.

CHAPITERS [in *Architecture*] are the Crowns or Upper-parts of a Pillar. Thoſe that are deſtitute of Ornaments, are called *Chapiters with Mouldings*, ſuch as the *Tuſcan* and *Dorick*; the firſt whereof is the moſt ſimple, having its *Abacus* ſquare, without any Mouldings; but the *Abacus* of the other is crowned with an *Aſtragal* and three *Annulets* under the *Echinus*. All thoſe that have Leaves, and carved Ornaments, are termed *Chapiters* with Sculptures, and the fineſt of them is the *Corinthian*, which is adorned with two Rows of Leaves, as alſo eight greater, and as many leſſer *Voluta's* placed under a Body called a *Tympanum*. Theſe are called uſually *Capitals*.

CHAPLET [in *Architecture*] is a little Ornament cut or carved into round Beads, Pearls, Olives, and Paternoſters, as is frequently done in Baguettes.



CHAPPE [in *Heraldry*] ſignifies cloathed, and is repreſented by dividing the Chief by Lines drawn from the Centre at the Upper-edge, to Angles below into three Parts; the Sections on the Sides being of a different Metal or Colour from the reſt, as in the Figure annexed. Some call it a *Chief Party per Bend dexter*, or *ſiniſter*, or both.

CHAPTER *Capitulum* [in the *Canon* and *Common-Law*] is either *Congregatio Clericorum in Eccleſia Cathedrali, regulari vel Collegiata*, or *Locus in quo fiunt communes tractatus Collegiatorum. Cowel.* Theſe Chapters aroſe thus: In ancient Times the Biſhops had their Clergy reſiding with them in their Cathedrals, to aſſiſt them in the Performance of ſacred Offices, and in the Government and Diſcipline of the Church: And even after Parochial Settlements were made, there were ſtill a Body of Clergymen which continued with the Biſhop at his Church, and were indeed his Family, and maintained out of his Income. After the Monaſtic Life grew into Requeſt and Reputation, many Biſhops choſe to have Monks rather than Seculars to reſide with them, and attend them in their Cathedrals. And theſe Bodies, of either Monaſtics or Seculars, had the ſame Privilege of chuſing the Biſhop, and being his Council, which the whole Clergy of the Dioceſe had before: But, by Degrees, their Dependance upon the Biſhop, and Relation to him, grew leſs and leſs; and when they had diſtinct Parcels of the Biſhop's Eſtate aſſigned for their Maintenance; at laſt the Biſhop had little more left than the Power of viſiting them. And on the other hand, theſe capitular Bodies did by Degrees alſo loſe their Privileges, particularly that of chuſing the Biſhop, for which the Kings of *England* had a long Struggle with the Pope; but at laſt *Hen.* VIII. got this Power veſted in the Crown, and now the Dean and Chapter have only the Shadow of it.

The ſame Prince did alſo eject the Monks out of theſe Cathedrals, and placed Secular Canons in their Room: And thoſe whom he thus regulated, are called *Deans and Chapters of the new Foundation*; as are *Canterbury*, *Wincheſter*, *Worceſter*, *Ely*, *Carliſle*, *Durham*, *Rocheſter*, and *Norwich*; and of ſuch ſort are the Chapters of the five new Sees of *Peterburgh*, *Oxford*, *Glouceſter*, and *Briſtol*, to which may be added *Weſtminſter*, tho' this laſt Biſhoprick is now ſunk, and the Monaſtery turned into a Collegiate Church by Queen *Elizabeth*.

CHAPTRELS [in *Architecture*] are the ſame with *Impoſts*, and ſignify thoſe Parts on which the Feet of Arches ſtand. Their Height or Thickneſs ought to be equal to the Breadth of the lower Part of the Key-Stone.

CHARACTERISTICK *of a Logarithm.* See *Index*, or *Exponent*.

CHARACTERS [of Καρακτηρ, *Gr.*] are *Marks*, *Signs*, or *Symbols*, of things invented by Artiſts, and peculiar to ſeveral Sciences, by which the Knowledge of the Things themſelves is always more expeditiouſly, and moſt times more clearly conveyed to the Learner; eſpecially after he hath a little enured himſelf to them.

Characters uſed by Mathematicians, are chiefly in Geometry, Trigonometry, *and* Algebra, *and are as followeth :*

= is the *Mark* of *Equality,* tho' *D. Cartes,* I know not why, inſtead of it, uſeth ∝, in which he is ſcarcely followed by any Body ; and this (=) Mark with him, or his Commentators, ſignifies the Difference of two Quantities, when 'tis not known which is the greateſt ; which now-a-days we mark thus ∽ : But now this Sign = is univerſally uſed for *equal to* ; and if you ſhould ſee $a = 2b$, you muſt read it, a is equal to twice b.

+ is, in *Algebra,* a Sign of real Exiſtence in the Quantity it ſtands before, and therefore all Quantities that have no Signs, are always ſuppoſed to have this Sign + before them. 'Tis called the *Affirmative* and *Poſitive Sign,* becauſe it implies the Quantity to be of a poſitive and real Nature ; and is directly contrary to the following Sign —.

This Sign + is alſo the *Mark* of *Addition,* and when you ſee $a + b$, you muſt read it, a added to b ; or, as the Way uſually is, a more b ; and you are to ſuppoſe it to be the Sum of thoſe two Quantities a and b.

— is the Note of *Negation, Negative Exiſtence,* or *Non-Entity,* in *Algebra* ; and whenever it ſtands ſingly before any Quantity, it ſhews that Quantity to be no real one, but leſs than nothing ; and therefore ſuch Quantities are called *Negative,* thus ; — 3 is a *Negative* 3, or 3 leſs than nothing. And tho' ſuch Quantities as theſe are only imaginary, they have yet very great Uſe in *Algebra :* And any one may have a diſtinct Idea of ſuch a Negative Quantity, if he conſider a Man to have in Caſh, or be worth but 1000 *l.* and yet to owe to 1500, for then that Man is certainly 500 *l.* worſe than nothing ; which Quantity of 500 *l.* in reſpect to him, will properly be expreſſed by putting this Negative Sign before it ; for 'tis truly to that Man — 500 *l.* or 500 *l.* leſs than, or worſe than nothing.

This *Character* is alſo the *Note of Subtraction,* and when you ſee $a - b$, you muſt read it, a ſubtracting, or abating ; or, as the uſual way is now, a leſs b ; implying, that the Quantity is the *Difference* between a and b, or the Remainder, when b the leſſer is ſubtracted from a the greater : Therefore this Note (as alſo doth the foregoing) always belongs to the Quantity following it.

∽ is the *Character* expreſſing the *Difference* between any two Quantities when 'tis not yet diſcovered which is the greater : And therefore the Sign — cannot be uſed, becauſe it always ſuppoſes the Quantity following to be leſs than what precedes it.

× is the *Character* of *Multiplication,* implying the Quantities on each Side the *Sign* are to be multiplied one into another. Thus $a \times b$ is to be read, a multiplied by b ; or the *Rectangle* between, or *Product* of, a and b. But this Sign in *Algebra* is uſually omitted, and the Quantities are put down like Letters in a Word, thus : ab ſignifies the Product of a multiplied by b. In compound Quantities the *Sign* is moſt times uſed, as, $a \times b \times c \times d - e$.

÷ is the *Mark* of *Diviſion,* thus : $a \div b$ ſignifies that the Quantity a is to be divided by b : But ſometimes, in *Algebra,* the Quotient is expreſſed Fraction-ways ; as, $\frac{a}{b}$ ſignifies the Quotient of a divided by b. Some Writers expreſs it thus : $b)\ a\ ($, as in the common Diviſion.

@- is the *Character* of *Involution,* as they call it ; that is, of producing the Square of any Quantity, or of multiplying any Quantity into itſelf. In *Branker* and *Pell's Algebra,* and ſince that, in *Ward's* and *others,* 'tis placed in the Margin, and ſhews that the Step of the Equation againſt which it ſtands is to be multiplied by itſelf, or ſquared ; or, if it be a Square already, then to be raiſed up to that Power, which the *Index* ſet after the *Character* expreſſes ; *v. g.*

1	@- 3	4	$aaa + 3aab + 3bba + bbb$

ſhews that the firſt Step of that Equation, which (was $n + b$) was, in the 4th Step, multiplied cubically, or raiſed up to the 3d Power.

ɯ is the *Character* of *Evolution* ; that is, of *Extraction of Roots out of the ſeveral Powers,* and is the Reverſe of the foregoing Sign @-.

: : is the Mark of *Geometrical Proportion disjunct,* and is uſually placed between two Pairs of Proportionals, as in the *Golden Rule,* thus ; 4 : 6 : : 8 : 12 ; and ſhews, that 4 hath the ſame Ratio to 6, that 8 hath to 12.

∺ is the Mark of *Geometrical Proportion continued,* and implies the Ratio to be ſtill carried on without any Interruption ; as, 2, 4, 8, 16, 32, 64, 128 ∺. Some *French* Writers uſe this Mark for *Arithmetical Proportion.*

√ : is the Sign of *Radicality,* and ſhews (according to the Index of the Power that is ſet over or after it) that the Square Cube, or other Root, is extracted, or is to be ſo, out of any Quantity ; as, √ : 25, or $\overset{2}{\surd}$ 25, or √ (2) 25, ſignifies the Square Root of 25 ; and $\overset{3}{\surd}$ 25, or √ : (3) 25, ſignifies the Cube Root of Twenty-five. Sometimes this *Radical Sign* belongs to as many of the following Quantities as have a Line drawn over them ; as, $\surd\overline{:b+d}$ ſignifies the Square Root of the Sum of b and d added together : And $\surd\overline{(3)\,f+c-g-3}$ ſignifies the Cube Root of the Sum of f and c, after g is ſubtracted from that Sum ; and that after this, 3 is to be taken from the ſaid Cube Root.

⊏ or ⌋ is the *Character* of *Greater,* and

⊐ or ∟ the Sign of the *Leſſer* of any two Quantities.

‖ is the *Mark,* or *Parallel,* and implies, that two Lines, or Planes, are equidiſtant from one another.

△ Triangle.

□ Square.

▯ ▭ Rectangle.

⊙ Circle, or *Sol* the Sun.

v Equi-angular, or Similar.

$\overset{=}{\underset{-}{\perp}}$ Equilateral.

∠ Angle.

∟ Right-Angle.

⊥ Perpendicular.

: : : is the Mark for Arithmetical Proportion.

$\dot{y}, \dot{x}, \dot{z}$. Any Letters with Points ſo over their Heads, denote the Fluxions of variable Quantities : And if they have two, three, or four Points, they denote Second, Third, or Fourth Fluxions. See *Fluxions.*

$^{-}1$, $^{-}2$, $^{-}3$, $^{-}4$, *&c.* are the Exponents of a Series of Fractions in a Geometrical Progreſſion.

$\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, are the Exponents of $\surd : x.\ \overset{3}{\surd} : x.\ \overset{4}{\surd} : x.$ which therefore in the new Notations are written thus, $x^{\frac{1}{2}}$, $x^{\frac{1}{3}}$, $x^{\frac{1}{4}}$, *&c.* Alſo $x^{\frac{4}{5}}$, ſtands for $\overset{5}{\surd}\, x^{4}$: And in Fractions, x^{-1}, x^{-2}, x^{-3}, ſtand for $\frac{1\ \ 2\ \ 3}{x\ \ x\ \ x}$, *&c.* Alſo $x^{\frac{1}{2}+\frac{1}{3}}$ expreſſes the Product of $x^{\frac{1}{3}}$ into $x^{\frac{1}{2}}$, and $x^{-\frac{1}{3}-\frac{1}{3}}$ (or $x^{-\frac{2}{3}}$) is the Product of $x^{-\frac{1}{2}}$, into itſelf, or Square of $x^{-\frac{1}{3}}$.

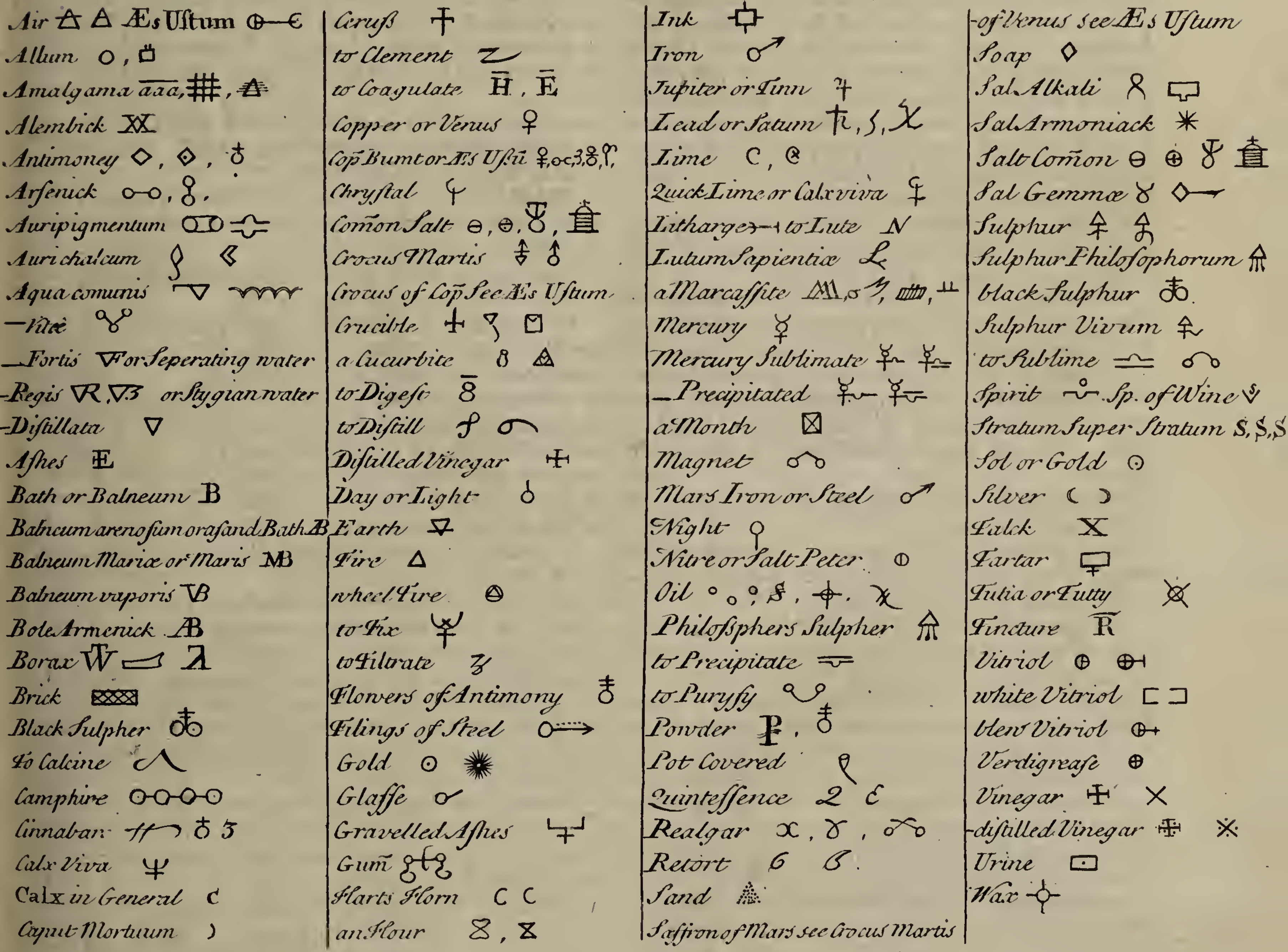
$x^{\frac{1}{2}-\frac{1}{3}}$ (or $x^{\frac{1}{6}}$) is the Exponent of the Quotient of $x^{\frac{1}{2}}$ by $x^{\frac{1}{4}}$.

$\overline{a+b}|^{-1}$ expreſſes an Unite divided by $a+b$.

$\overline{a+b}|^{-3}$ is an Unite divided by the Cube of $\overline{a+b}$.

$\overline{a+b}|^{\frac{2}{4}}$ is the Biquadratick Root of the Cube of $a+b$.

CHARACTERS CHYMICAL


Air 🜁 △ Æs Uſtum
Allum
Amalgama aaa
Alembick
Antimoney ♁
Arſenick
Auripigmentum
Aurichalcum
Aqua comunis ▽
—Vitæ
—Fortis ▽F or Seperating water
—Regis ▽R, ▽3 or Stygian water
—Diſtillata ▽
Aſhes
Bath or Balneum B
Balneum arenoſum or a ſand Bath ÆB
Balneum Mariæ or Maris MB
Balneum vaporis VB
Bole Armenick ÆB
Borax
Brick
Black Sulpher
To Calcine
Camphire
Cinnabar
Calx Viva
Calx in General
Caput Mortuum
Ceruſs
to Clement
to Coagulate H̄, Ē
Copper or Venus ♀
Cop̄ Burnt or Æs Uſtū
Chryſtal
Comon Salt ⊖
Crocus Martis
Crocus of Cop̄ See Æs Uſtum
Crucible
a Cucurbite
to Digeſt
to Diſtill
Diſtilled Vinegar
Day or Light
Earth 🜃
Fire △
wheel Fire
to Fix
to Filtrate
Flowers of Antimony
Filings of Steel
Gold ☉
Glaſſe
Gravelled Aſhes
Gum̄
Harts Horn C C
an Hour
Ink
Iron ♂
Jupiter or Tinn ♃
Lead or Saturn ♄
Lime C
Quick Lime or Calx viva
Litharge to Lute
Lutum Sapientiæ
a Marcaſſite
Mercury ☿
Mercury Sublimate
—Precipitated
a Month ⊠
Magnet
Mars Iron or Steel ♂
Night
Nitre or Salt Peter ⦶
Oil
Philoſophers Sulpher
to Precipitate
to Puryfy
Powder
Pot Covered
Quinteſſence
Realgar
Retort
Sand
Saffron of Mars see Crocus Martis
-of Venus see Æs Uſtum
Soap ◇
Sal Alkali
Sal Armoniack ✳
Salt Comon ⊖ ⊕
Sal Gemmæ
Sulphur 🜍
Sulphur Philoſophorum
black Sulphur
Sulphur Vivum
to Sublime
Spirit Sp. of Wine
Stratum Super Stratum S, $, S
Sol or Gold ☉
Silver ☾ ☽
Talck X
Tartar
Tutia or Tutty
Tincture R
Vitriol ⊕
white Vitriol ⊏ ⊐
blew Vitriol
Verdigreaſe ⊕
Vinegar ✕
-diſtilled Vinegar
Urine
Wax

CHARGE [in *Heraldry*] ſignifies whatever Thing is born in the Field of a Coat of Arms; whether Animal, Vegetable, or any other Repreſentation or Figure. *Proper Charges* are called *Ordinaries*; which ſee. Thus *Guillim*: But *Bloom* calls thoſe *Charges* on which Rewards and Additions of Honour are often placed in a Coat of Arms, ſuch as *Cantons*, *Quarters*, *Gyrons*, *Flasks*, *&c.*

CHARGE. The Seamen call a Ship, *A Ship of Charge*, when ſhe draws much Water, or ſwims deep in the Sea; and ſometimes 'tis uſed for an unweildy Ship that will not ware nor ſteer, for ſuch a one they ſay alſo is a *Ship of Charge*.

CHARGE *of Lead* is 36 Pigs, and each Pig contains 6 Stone, wanting two Pound; *i. e.* every Stone (here) is 12 Pound.

CHARGED CYLINDER is that Part of the *Chace* of a great Gun where the Powder and Ball are placed.

CHARLES's WAIN, ſeven Stars in the Conſtellation called *Urſa Major*.

CHART or *Sea Chart*, a Hydrographical Map, or a Projection of ſome Part of the Sea, in *Plano*, for the Uſe of Navigation. See *Plain Chart*, and *Mercator's Chart*.

CHARTA *Pardonationis ſe defendendo* is the Form of a Pardon for ſlaying another Man in his own Defence.

CHARTA *Pardonationis utlagariæ*, is the Form of a Pardon for a Man that is outlawed.

CHARTER [in *Law*] is a written Evidence of any thing done between Man and Man: And ſometimes Charters are called *Charters of the King*; as, when the King paſſeth any Grant to any Perſon, Body Politick, *&c.* to excuſe a Man from being impannelled on a Jury; *Charters of Pardon*, whereby Men are forgiven Felonies, *&c.*

CHARTER-LAND is ſuch Land as a Man holds by Charter; *i. e.* by Deed or Evidence in Writing; and this is otherwiſe called *Freehold.*

CHARTER-PARTY is an Indenture of Covenants and Agreements made between Merchants, or between Owners of Ships and the Maſters and Seafaring Men, touching their Affairs, or Commanders. It is properly a Deed or Policy whereby the Maſter or Owner of the Veſſel engages to furniſh immediately a tight ſound Ship, well equipp'd, caulk'd, and ſtopped, provided with Anchors, Sails, Cordage, and all other Furniture, to perform the Voyage required; as, Equipage, Hands, Victuals, and other Neceſſaries, for a certain Sum to be paid by the Merchant for the Freight.

CHARTIS *Reddendis* is a Writ which lies againſt him that hath Charters of Feoffment delivered him to keep, and refuſeth to deliver them.

CHARTS [*Chartæ*, L. *Papers*] Deſcriptions or Draughts of any Place, Hydrographical Maps, or Projections of ſome Parts of the Sea *in Plano.*

CHARTS uſed at *Sea*, are either the *Plain* or *Mercator's Charts*, as they are uſually called, tho' the laſt ſhould indeed be rather called *Wright's Chart.* See the Words *Plain-Chart* and *Mercator's Chart.*

Chorographick CHARTS are a Deſcription of particular Countries.

Geographick CHARTS, general Draughts of the whole Globe of the Earth upon a Plane, commonly called Maps of the World.

Heliographick CHARTS, Deſcriptions of the Body of the Sun, and of the Maculæ or Spots obſerved it.

Hydrographick CHARTS are Sheets of large Paper whereon ſeveral Parts of the Land and Sea are deſcribed, with their reſpective Coaſts, Harbours, Sounds, Flats, Shelves, Sands, Rocks, *&c.* together with the Longitude and Latitude of each Place, and the Points of the Compaſs.

Marine or *Sea* CHARTS. See *Hydrographick Charts.*

Selenographick CHARTS, particular Deſcriptions of the Parts, Appearances, and Maculæ of the Moon.

Topographick CHARTS are Draughts of ſome ſmall Parts of the Earth only, or of ſome particular Places, without Regard to its relative Situation, as *London*, *York*, *&c.*

CHASE. To chaſe is to purſue a Ship at Sea, which is called *Giving Chaſe.*

A Stern CHASE is when the Chaſer follows the Chaſed a-ſtern, directly upon the ſame Point of the Compaſs.

To lie with a Ship's Fore-foot in a CHASE, is to ſail and meet with her by the neareſt Diſtance, and ſo to croſs her in her Way, or *to come a-croſs her Fore-foot.*

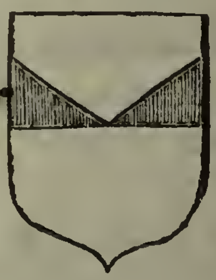
A Ship with a good forward CHASE, a Ship that is ſo built forward on a-ſtern, that ſhe can carry many Guns to ſhoot right forwards or backwards, called alſo a *Ship of a good Stern-Chaſe.*

CHASE *of a Gun* is its whole Length.

CHASE-GUNS are ſuch whoſe Ports are either in the Head (and then they are uſed in chaſeing of others) or in the Stern, which are only uſeful when they are purſued or chaſed by any Ship or Ships.

CHATTELS [*Catalla*] is a Word which came to us from the *Normans*, who called all movable Goods by this Name, the contrary was called *Fief*, or as we now call it, *Fee*: But now, in our Law, *Chattels* are all ſorts of Goods, movable and immovable, except ſuch as are in the Nature of Freehold, or Parcel thereof. They reckon *Chattels* alſo to be either perſonal or real. The former are ſuch as either do belong immediately to the Perſon of a Man, as his Horſe, Sword, *&c.* or ſuch things as being injuriouſly withheld from him, a Man hath no way to recover but by perſonal Action. But *Chattels real* do not appertain to the Perſon, but to ſome other thing by way of Dependance, as a Box with Charters of Land, Apples upon a Tree, *&c.* Such things alſo as neceſſarily iſſue out of ſome immovable Thing to a Perſon, as a Leaſe or Rent for Years, they call a *Chattel real.* Alſo to hold at Will is a *Chattel real.*

CHAUNTRY is a Church or Chapel endowed with Lands or other yearly Revenue, for the Maintenance (formerly) of one or more Prieſts daily ſaying or ſinging Maſs for the Souls of the Donors, and ſuch others as they ſhall appoint.

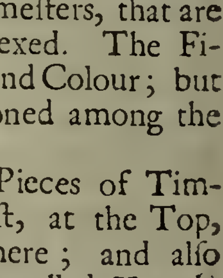


CHAUSSE [in *Heraldry*] ſignifies *Shod*, and [in *Blazonry*] denotes *a Section in Baſe*, the Line by which it is formed proceeding from the Extremity of the Baſe, and aſcending to the Side of the Eſcutcheon, which it meets about the *Feſſe-point*, as if a Chief had Shoes, as *Emanche* is ſaid to repreſent Sleeves.

CHAUSSE [in *Fortification*] the Level of the Field, the plain Ground.

CHAUSSE-TRAPPES, or *Coltrops* [in *Fortification*] are Iron Inſtruments with four Spikes about four Inches long, made after ſuch a Manner, that whatſoever Way they fall, one Point will always lie uppermoſt, like a Nail. They are uſually ſcatter'd, and thrown into Moats and Breaches, to gall the Horſes Feet, and to ſtop the haſty Approach of the Enemy.

Clerk of the CHECK, an Officer of the Court ſo called, becauſe he has the Check and Entrolment of the Yeomen of the Guard, and all Officers of the King, Queen, or Prince.



CHECKEY [in *Heraldry*] is one of the moſt noble and moſt ancient Figures that are uſed in Armory, and a certain Author ſaith, ought to be given to none but valiant Warriers, in Token of their Nobility; for the Cheſs-board repreſents a Field of Battle, and the Pawns and Men on both Sides, repreſent the Soldiers of two Armies, which move, attack, advance, or retire, according to the two Gameſters, that are their Generals. See the Figure annexed. The Figure is always compoſed of Metal and Colour; but ſome Authors would have it reckoned among the ſeveral Sorts of Furrs.

CHEEKS are [in a *Ship*] two Pieces of Timber fitted on each Side of the Maſt, at the Top, ſerving to ſtrengthen the Maſt there; and alſo having Holes in them (which are called *Hounds*) thro' which the Ties run to hoiſt the Yards.

Alſo, the uppermoſt Rail or Piece of Timber in the Beak of a Ship, and thoſe on each Side the Trail-board, are called the *Upper* and *Lower Cheek.* The Knees alſo which faſten the Beak-head to the Bows of a Ship are called *Cheeks* ; and ſo are the Sides of any Block, as alſo the Sides of a Ship-Carriage for a Piece of Ordnance.

CHELONE [Χελωνὴ, *Gr.* a *Tortoiſe*] a Surgeon's Inſtrument to make a gradual Extenſion in any fractured Member, in which Motion it reſembles the Slowneſs of a Tortoiſe.

CHEMICE, the Art of caſting Figures in Metals.

CHEMIN *de Ronds* [in *Fortification*] is the way of the Rounds, or a Space between the Rampart and the low Parapet under it for the Rounds to go about. The ſame with the *Fauſſe Bray.*

CHEMISE [in *Fortification*] is a Wall with which a Baſtion, or any other Bulwark of Earth is lined for its greater Support and Strength ; or it is the Solidity of the Wall from the *Talus* to the Stone-Row.

CHEMOSIS is the Tumour of the *Albugineous Tunick* that maketh the Black of the Eye appear concave, being a very great Inflammation of the Eyes, with vehement Pain, both the Eye-lids being turned the Inſide out, ſo that the Eyes can ſcarcely be covered with them, whilſt the White of the Eye ſtands higher, and the Red runs over moſt part of the *Iris.*

CHERSONESUS, a Term in *Geography*, being the ſame with *Peninſula*, and ſignifies a Part of the Land encloſed all round about with Water, except one narrow Neck, by which it joins to the Main-Land ; and that Neck is called an *Iſthmus.*

CHESS. *Ardſhire Ebn Babec* King of *Perſia* having invented the Game of *Trictrac*, by which, as he pretended, were repreſented the Univerſal Phænomena of Nature, the Tables being divided into twelve Points, agreeable to the Number of Months in a Year ; and there being 30 Pieces, as there are Days in a Month, the Motion of the Die's, which have always Seven upon their two oppoſite Sides, of which the one is viſible, or above the Horizon, while the other is hid below, being modelled according to the Number and Motion of the Planets. This Game, which is ſeemingly governed by Chance, but depends upon the above Particulars, and is ſometimes favourable and ſometimes not, is a true Repreſentation of human Actions, which are ſometimes happy and ſometimes unhappy ; which Conſequences we are always ignorant of before they happen, altho' they be foreknown, and even directed by the Sovereign Author of all Things. This Mixture of Chance and Foreſight, makes a good Player at *Trictrac* half Maſter of the Reſult of the Game ; ſo that the Gain or Loſs depends in ſome meaſure upon his Ability in the Game : Which Conſiderations makes the Analogy appear to be ſomewhat ſimilar between the Viciſſitudes of the World and that of *Trictrac.*

The People of the Eaſtern Nations were ſo taken with this Compariſon, that they thought the Diſcovery of the King of *Perſia* to be a Maſter-Piece of human Invention.

Some modern Geometricians have remarked, that there has been a great deal of Judgment in the Invention of moſt Games ; but they ought not to have added, that the Diſcovery of the greateſt Part of Games has been owing to Chance : For *Trictrac*, in particular, is owing to ſolid Reaſoning ; and, which is ſtill more to the Honour of Geometricians, it is owing to Geometrical Reaſoning : For *Adſhire Ebn Babec* was in general a great Mathematician, and particularly a great Aſtronomer ; and having invented the Game of *Trictrac*, he propoſed the various Chances of it as a Queſtion to be ſolved by his neighbouring *Princes*, or by the *Literati* of thoſe Eaſtern Nations, about which time *Trictrac* was the only Game that was played, or even talked of, in all the Eaſtern Countries.

O happy Days ! when there was amongſt *Princes*, *Noblemen*, and *Gentlemen*, ſuch a noble Emulation for the Improvement of Arts and Sciences in general, and particularly for thoſe that are Geometrical, as knowing them to be the Baſis of all the reſt.

Shehram an *Indian* King, being piqued at the Diſcovery made by the King of *Perſia*, he offered great Rewards to the Geometricians in his Dominions, if any of them would invent a Game that might be oppoſed to that of *Trictrac.* The Succeſs whereof ſurpaſſed his Expectation ; for one *Shehſa*, or *Seſſa*, invented a Game, which, from his own Name, or from that of King *Shehram*, was called *Shehrange*, or *Sheſhranc*, and which we call by the Name of *Cheſs.* Our *Arabian* Author ſays, That the *Learned* reckon'd the Game of *Cheſs* to ſurpaſs that of *Trictrac* very much.

The *Indian* King was ſo taken with the Game of *Cheſs*, that he ordered *Seſſa* to mention what Reward he could even wiſh for, if it was to the Half of his Empire, he would give it him. *Seſſa* not having Occaſion for any pecuniary Recompence, replied, That his Majeſty's Approbation of the Diſcovery, and the Eſteem he was pleaſed to ſhew for him, was a ſufficient Reward : However, the King inſiſting upon making good his Royal Promiſe, was anſwered by *Seſſa*, That there being 64 ſmall Squares upon the *Cheſs-Board*, if he muſt have a Reward, it ſhould be One Grain of Barley laid upon the firſt Square, 2 upon the Second, 4 upon the Third, 8 upon the Fourth, 16 upon the Fifth, *&c.* always doubling the Number of Grains to the 64th or laſt Square.

The King being leſs ſkilled in Geometry than his Courtier, praiſed his Modeſty, and ordered that he might have at leaſt ſeveral Granaries full of Barley : But *Seſſa*, pleaſed with being praiſed for his Modeſty, and having an Opportunity of ſhewing his ſuperior Genius, inſiſted upon his firſt Demand ; upon which the King, being willing to ſatisfy *Seſſa* for his excellent Diſcovery, ordered one of his Under-Secretaries to calculate the exact Number of Grains of Barley that *Seſſa* demanded ; but the King was ſurprized, when he was anſwered, That it was a ſufficient Taſk for all the Secretaries and learned Men of the Court : Therefore ſeveral of their beſt Mathematicians being ſet to Work, and having made ſome Progreſs in the Calculation, ſaw that *Seſſa*'s Demand was not ſo ſmall as was thought at firſt ; for at the 16th Square, they were aſtoniſhed, and aſſured the King, that the Number of Grains to be laid on all the Squares would amount to ſeveral Meaſures of Barley, for the Number to be laid upon the 16th Square amounted to 32768, which makes the Meaſure *Kabah* ; and continuing their Calculation, they found that the Number of Grains to be laid on the 40th Square was ſufficient to fill a Granary equal in Bigneſs to a pretty large City ; and by doubling and redoubling that Granary, till they came to the 50th Square, they found that the Grains of Barley to be laid thereon would fill 16384 ſuch Granaries ; and our *Arabian* Author obſerves, that a Geometrician of *Alexandria* having made the Calculation, declared, That *if all the Cities in the World were Granaries, they would ſcarce be ſufficient to contain ſuch a Quantity of Barley.*

The Number of Barley-Grains demanded by *Seſſa* is 18446744073709551615, by which the King ſaw plainly that *Seſſa* was above accepting any Reward beſides his Favour and Eſteem.

All the various Ways of playing a Game at *Cheſs* are excellently laid down by a *French* Author named *Calabroi.*

CHESSE-TREES are two ſmall Pieces of Timber with a Hole in them, on each Side of the Ship, a little before her Loof, for the Main-Tack to run thro', and to which it is haled down.

CHEST [in *Anatomy*] the Breaſt, that hollow Part of a human Body which contains the Heart and Lungs.

CHEST-ROPE [with *Mariners*] a Rope added to the Breaſt-Rope, when the Boat is towed at the Stern of the Ship, to keep her from ſhearing or ſwinging to and again.

CHEVAUX *de Friſe*, or *Friſeland Horſe* [in *Fortification*] is a large Joiſt or Piece of Timber about a Foot in Diameter, and ten or twelve in Length; into the ſix Sides thereof are driven a great Number of Wooden Pins about 6 Foot long, croſſing one another, and having their Ends armed with Iron Points. Their chief Uſe is to ſtop up Breaches, or to ſecure the Avenues of a Camp from the Inroads both of Horſe and Foot. They are much the ſame with *Turnpikes.*

CHEVELLE [in *Heraldry*] ſignifies Streaming; *i. e.* a Stream of Light darting from a Comet or Blazing-Star, vulgarly called a Beard, according to the Figure annexed.

CHEVILS, or *Kevils*, are ſmall Pieces of Timber nailed to the Inſide of a Ship, to belay or faſten the Sheets and Tacks.

CHEVRON, one of the Honourable Ordinaries in Heraldry; it repreſents two Rafters of an Houſe ſet up as they ought to ſtand, and was anciently the Form of the Prieſteſſes Head-Attire. Some ſay it is a Symbol of Protection, others ſay of Conſtancy, tho' others ſay, it repreſents Knights Spurs, others a Piece of Lyſt, or the Barriers of a Park, *&c.* It contains the 5th Part of the Field, and is figured thus.

He beareth *Gules*, a *Cheveron Argent*, by the Name of *Fulford.*

A *Chevron* is ſaid to be *abaiſſed* when its Point does not approach the Head of the Chief, nor reach farther than the Middle of the Coat; *mutilated*, when it does not touch the Extremes of the Coat; *cloven*, when the upper Pieces are taken off, ſo that the Pieces only touch at one of the Angles; *broken*, when one Branch is ſeparated into two Pieces; *couched*, when the Point is turned towards one Point of the Eſcutcheon; *divided*, when the Branches are of ſeveral Metals, or when Metal is oppoſed to Colour; *inverted*, when the Point is towards the Point of the Coat, and its Branches towards the Chief.

Per CHEVRON [in *Heraldry*] is when the Field is divided only by two ſingle Lines, riſing from the two Baſe Points, and meeting at the Point above, as the *Chevron* does, and is alſo called *Party per Chevron.*

CHEVRONED [in *Heraldry*] when it is filled with an equal Number of *Chevrons*, of *Colour*, and *Metal.*

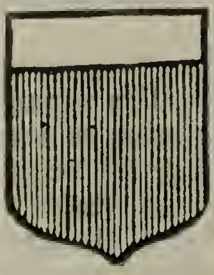
CHEVRONNE, CHEVRONNY, ſignifies a Shield parted ſeveral times *Chevron*-ways.

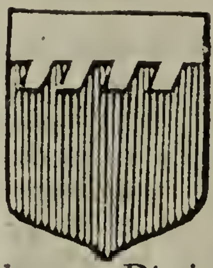
CHIEF, of *Chef*, F. the *Head* [in *Heraldry*] is the Upper-part of the Eſcutcheon, reaching quite acroſs from Side to Side. The *Chief* is ſaid to be *abaiſs'd* when it is detach'd from the Upper-end of the Coat by the Colour of the Field which is over it, and which takes from it one third Part of its Height.

CHIEF *chevroned*, *paled*, or *bended*, is when it has a Chevron, Pale, or Bend, contiguous to it, and of the ſame Colour with the *Chief.*

CHIEF *ſupported* [in *Heraldry*] is when the two Thirds at Top are of the Colour of the Field, and that at the Bottom of a different Colour.

CHIEF, one of the eight Honourable Ordinaries in *Heraldry*, containing a third Part of the Field, and determined by one Line, either ſtreight or crooked, that is, *Invected*, *Engrailed*, *&c.* drawn thro' the *Chief Point* of the Eſcutcheon. Thus the Field is *Gules*, a *Chief Argent.* He beareth *Gules*, a *Chief Crenelle*, or *Embatteled Argent.*





Sometimes one *Chief* is born upon another, which is called *Surmounting*, and it is uſually expreſſed by a Line drawn along the Upper-part of the *Chief*; for if the Line be drawn along the Lower-part of the *Chief*, it is called a *Fillet.* The former of theſe is an Addition, the latter a Diminution, of Honour.

CHIEF *Point.* See *Eſcutcheon.*

CHILIADS are the *Tables of Logarithms*, and ſo called becauſe they were at firſt divided into Thouſands. Thus in the Year 1624, Mr. *Briggs* publiſhed a *Table of Logarithms* for 20 *Chiliads* of abſolute Numbers, and again for 10 *Chiliads* more, and then for one more; that is, for 31 *Chiliads.* The Book is called *Arithmetica Logarithmica.*

A. D. 1628, *Adrian Viacq* publiſhed this again, with a Supplement (according to Mr. *Briggs*'s Direction) of the *Chiliads* before admitted; in all making up 101 *Chiliads.*

CHILIAGON [of Χιλιὰς, *Gr.* 1000, and *γωνία*, *Gr.* a *Corner*] is a Regular Plane Figure of 1000 Sides and Angles; of which, tho' the Eye can form no diſtinct View, we may have a very clear Idea in the Mind, and can eaſily demonſtrate, that the Sum of all its Angles is equal to 1996 Right ones; for the internal Angles of every Plane Figure, are equal to twice as many Right Angles as the Figure hath Sides, except thoſe Four which are about the Point in the Middle, from whence the Figure is reſolved into Triangles.

CHIMÆRA, CHIMERA [*Χίμαιρα*, *Gr.*] a mere Whimſy, an idle Fancy, a feigned Monſter, ſaid to have the Head of a Lyon, the Belly of a Goat, and the Tail of a Serpent.

CHIMES *of any Clock.* How to calculate Numbers for them, and to fit and divide the *Chime-Barrel*: See *Watch-Work.*

CHIMNEY is a particular Part of a Houſe deſigned for the Conveniency of Firing, with a Tube or Tunnel to convey away the Smoak.

The Rules for building Chimneys are: 1. That no Timber be laid within 12 Inches of the Foreſide of the Chimney-Jambs.

2. That all the Joiſts on the Back of any Chimney be laid with a Trimmer.

3. That no Timber be laid within the Tunnel of any Chimney.

The Parts of a Chimney are reckoned Five: 1. The *Jambs* or Sides, coming out perpendicularly, and ſometimes circularly, *&c.* from the Back. 2. The *Mantle-Tree*, which reſts on the Jambs. 3. The *Tube* or *Tunnel*, which conveys away the Smoke. 4. The *Chimney-Piece*, or Moulding, on the Fore-ſide of the Jambs over the Mantle-tree. 5. The *Hearth*, or Fire-place.

The Proportions for Chimneys *Palladio* lays down for the Breadths and Depths (on the Inſide) and for their Height to the Mantle-tree, according to the following Table.

Chimneys in	Breadth.	Height.	Depth.
	Foot.	*Foot.*	*Foot.*
Halls	6, 7, or 8	4½ or 5	2½ or 3
Chambers	5½, 6, or 7	4 or 4½	2 or 2½
Studies Wardrobes	4, 4½, or 5	4 or 4½	2 or 2½

Nevertheleſs in theſe Points a Workman ought rather to be govern'd by the Modern Faſhions, than by the Words of an ancient Architect.

Wolfius directs, that the Breadth of the Aperture at the Bottom be to the Height as 3 to 2, to the Depth as 4 to 2.

In ſmall Apartments, the Breadth 3 Foot, in larger 5, in Bed-chambers 4, in large Banqueting-Rooms 5½, in larger 6.

But that the Height ſhould never exceed 2 and a Half, leſt there being too much Room for the Air and Wind, the Smoke ſhould be driven down into the Room: Nor ſhould the Height be too little, leſt the Smoke miſs its Way, and be checked at its firſt ſetting out. He alſo adviſes to leave an Aperture thro' which, on Occaſion, the external Air may be let into the Flame, to drive the Smoke up, which otherwiſe the external Air would not be able to do.

Mr. *Felibien* directs, that the Mouth of the Tube, or that Part to the Chimney-back, be made a little narrower than the reſt, that, if the Smoke be repelled downwards, it may be prevented from getting into the Room by this Obſtacle.

To prevent Smoking, Mr. *Lucar* (in his *Solace*) directs to leave two Holes, one over another, on each Side of the Chimney, the one ſloping upwards and the other downwards, or elſe to place two Pipes in the ſame Poſition on each Side of the Chimney; and he is of Opinion, that if this be done, which Way ſoever the Wind blows, the Smoke will paſs freely out of any Tunnel.

Some make the Tunnel twiſted, to prevent the Smoke's deſcending too eaſily; but others recommend the making the Tunnel narrower at the Bottom than at the Top, as the better Expedient; becauſe when it is contracted at the Bottom, the Fire will impel the Smoke up more eaſily, and in mounting, it will find more Space to diſengage itſelf, and therefore will have leſs Occaſion to return into the Chamber.

Philip d'Ormes directs, to place a hollow Braſs Ball of a reaſonable Capacity, with a little Hole on one Side for the Reception of Water, which Ball being filled with Water, to be placed, the Hole upwards, upon an Iron Wire that ſhall traverſe the Chimney a little above the Mantle-tree, at the ordinary Height of the greateſt Heat or Flame, and ſo when the Water is hot, it will be rarefied, and break out of the Hole in a windy or vapoury Stream, and ſo force up the Smoak, which otherwiſe might linger in the Tunnel by the Way, and would frequently turn back again.

Some are of Opinion, that it would be the better if this Ball were made with a ſhort Noſe to ſcrew off, when it is filled with Water, and then the Hole of this Noſe need not be any bigger than that at the ſmall End of a Tobacco-Pipe.

And likewiſe, that it would be better if there were two of theſe Balls, and then one of them might ſupply the Place of the other when it is exhauſted; or, upon Occaſion, might blow the Fire in the mean time.

Others recommend a kind of moveable Vane, or Weather-cock (which ſome call a Beggar-man) to be placed at the Top of a Chimney, the Back-ſide of which is covered with Plates of Tin, ſo that, which Way ſoever the Wind comes, it can never keep down the Smoke of the Chimney, the Aperture of the Chimney being ſkreened, and ſo the Smoke will always come out free and undiſturbed. This laſt Contrivance has been found, by Experience, to help Chimneys that have ſmoked very much.

But after all, the beſt Way to prevent ſmoking Chimneys, is, by a proper Situation of the Doors of the Room, and the apt Falling of the Back, and the convenient gathering of the Wings and Breaſt of the Chimney.

CHIMNEY *Jambs* are the Sides of a Chimney, as before.

CHIMNEY *Piece* is a Compoſition of certain Mouldings of Wood, or Stone, ſtanding on the Fore-ſide of the Jambs, and coming over the Mantle-tree.

CHIRAGRA is a ſort of Gout in the Hands only.

CHIROGRAPHER is he that, in the *Common-Pleas*, ingroſſes Fines acknowledged in that Court into a perpetual Record, (after they are acknowledged and fully paſſed by thoſe Offices by whom they are firſt examined) and that writes and delivers the Indentures, one for the Buyer, and another for him that ſells, and makes another indented Piece, containing alſo the Effect of the Fine, which he delivers over to the *Cuſtos Brevium*, which is called *The Foot of the Fine.*

The *Chirographer* alſo, or his Deputy, proclaims all the Fines in the Court every Term, according to the Statutes, and then repairing to the Office of the *Cuſtos Brevium*, there endorſes the Proclamations upon the Back-ſide of the Foot thereof, and always keeps the Writ of Covenant; as alſo the Note of the Fine.

CHIROGRAPHY [Χειρογραφία, *Gr.*] A Writeing under one's own Hand.

CHIROMANCY [Χειρομαντεία, of Χεὶρ a *Hand*, and μαντεία, *Gr. Divination*] a kind of Divination, whereby they pretend to diſcover the Conſtitution and Tempers of Perſons, and to predict future Events, by the Lines, Wrinkles, and Marks, in the Hand.

CHIRONIUM *Ulcus* [in *Surgery*] a Boil or Sore which comes eſpecially on the Thighs and Feet, ſo called, becauſe it has need of ſuch a one as *Chiron* the celebrated Phyſician to cure it.

CHISSELS uſed in *Joinery* and *Carpentry*, are of ſeveral Kinds: As,

1. The *Former*, which is uſed firſt of all, before the *Paring Chiſſel*, and juſt after the Work is ſcrib'd, and a little without the ſcribed Strokes, and with its Baſil outwards.

2. The *Paring Chiſſel* hath a very fine and ſmooth Edge, and 'tis uſed to pare off, or ſmooth the Irregularities which the *Former* makes. This is not ſtruck with the Mallet, as the *Former* is, but preſſed with the Shoulder of the Workman, who holds the *Chiſſel* between the Fore and Little-finger of his Right-hand, and with the two Middle-fingers clutched upon it.

3. The *Skew-Former*, which is a *Chiſſel* uſed for cleanſing acute Angles by the Point or Corner of its narrow Edge, and where the Angles of other *Chiſſels* cannot come.

4. The *Mortice Chiſſel* is narrow, but very thick and ſtrong, to endure hard Blows with the Mallet, and 'tis ground to a very broad Baſil; its Uſe is, to cut deep ſquare Holes in the Wood, which are called *Mortices*: Theſe are of ſeveral Sizes, according as the Breadth of the *Mortices* require.

5. The *Gouge* is a *Chiſſel* with a round Edge, one Size of which ſerves to prepare the Way for an Augre, and others, to cut ſuch Wood as is to be rounded or hollowed, *&c.*

6. *Socket Chiſſels* are ſuch as are chiefly uſed by Carpenters, and have their Shank made with a hollow Socket at the Top, to receive a ſtrong Wooden Sprig made to fit into that Socket, with a ſquare Shoulder above it, which makes them very ſtrong to bear the heavy Blows of the Mallet: They diſtinguiſh theſe *Socket Chiſſels* according to the Breadth of the Blade, and call them Half Inch, Three-quarter Inch, Inch and Half, two Inch, and three Inch, *Chiſſels*.

7. The *Ripping Chiſſel* is a Socket Chiſſel about an Inch broad, and having a blunt Edge with no Baſil to it; its Uſe is to rip and tear two Pieces of Wood faſtened together from one another, by forcing in the blunt Edge between the two Pieces.

CHIVALRY [in our *Law*] ſignifies a Tenure of Land by Knights Service, or by Obligation to perform ſome Martial or Military Office to the Lord.

CHIVES is the Botanick Word by which our Mr. *Ray* renders the *Latin*, *Apices*; which ſee. But Dr. *Grew* calls the *Stamina* on which the *Apices* are fixed, by this Name of *Chives*.

CHIVES *tipt with Pendants* [*Botany*] is when the Horn or Thread of a Flower has a Seed hanging and ſhaking at the Point of it, as in Tulips, *&c.*

CHIVETS [*Botany*] the ſmall Parts of the Roots of Plants, by which they are propagated.

CHLOROSIS [of Χλωρότης of Χλωρίζω, *Gr.* to *appear green*] or *Morbus Virgineus*, commonly call'd *Icterus Albus*, or the *Green Sickneſs*, ſeems to be a kind of phlegmatick pituitous Dropſy, ariſing from an Obſtruction of the *Menſes*, want of Fermentation in the Blood, and Detention or Depravation of the Ferment in the Womb; whereupon the Muſcular Fibres being obſtructed, they become lazy and unfit for Action. *Blanchard.*

CHONA is a ſort of Cavity or Tunnel in the Baſis of the Brain, by which the ſerous Excrements are brought down from the Ventricles of the Brain to the Pituitary Glandules; alſo the Pelvis of the Reins; of which in its proper Place. *Blanchard.*

CHOLAGOGUES [Χολαγωγὸς of Χολὴ and ἄγω, *Gr.* to *draw*] are Medicines which purge Choler, ſulphureous and bilious Humours; as, *Rhubarb*, *Senna*, *&c.* according to the old Notion.

CHOLEDOCHUS *Ductus* [of Χολὴ, *Bile*, and δέχομαι, *Gr. I receive*] is the Communion of the *Ductus*, or *Porus Bilarius*, with the *Ductus Cyſticus*, into one Paſſage, and is thence called the *Ductus Communis Choledochus*. This goes obliquely to the lower End of the *Duodenum*, or the Beginning of the *Sejunum*, and creeping obliquely between the Tunicks of the Inteſtine, hath the Return of the *Bile* hindered (as by a Valve) from coming into the *Ductus* again.

CHOLER. See *Bile*.

CHOLERA *Morbus* is a depraved Motion of the Ventricle and the Guts, whereby the bilious Excrements are diſcharged in great Plenty upwards and downwards. *L. Blanchard.*

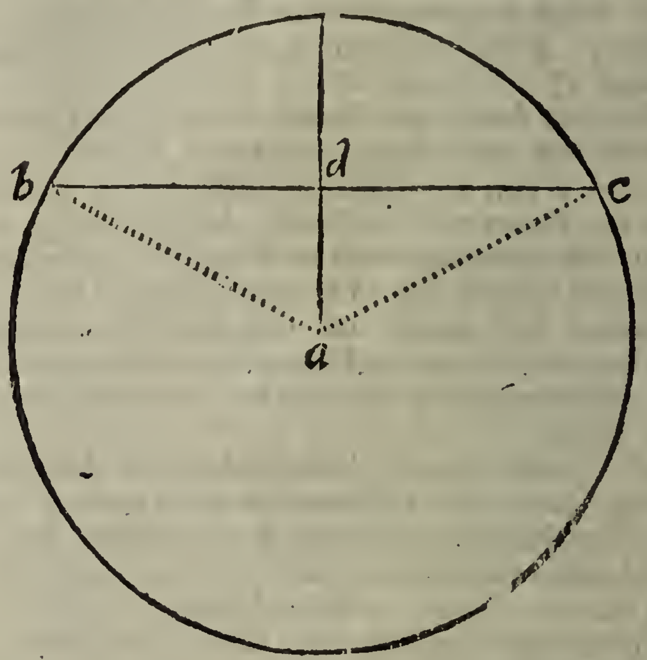
CHONDROGLOSSUM [of Χόνδρος and γλῶσσα, *Gr.* the *Tongue*] a very ſmall Pair of Muſcles of the Tongue, very ſhort and narrow, ariſing from the cartilaginous Proceſſes of the *Os Hyoides*, and meeting in the Middle of the Baſis of the Tongue, where they are inſerted, forming an Arch under it, mentioned by *Verſiegen*, and others.

CHONDROSYNDESMUS [Χονδροσυνδεσμος of Χόνδρος and συνδεσμος, *Gr.* a *Binding*] the joining or uniting of the Bones by a Cartilage placed betwixt them.

CHORD [in *Geometry*] is a Right-Line connecting the Extremities of any Arch of a Circle, and is otherwiſe called a *Subtenſe*.

PROP. I.

A *Chord* (*b c*) is biſected by a Perpendicular (*d a*) drawn from (*a*) the Centre.



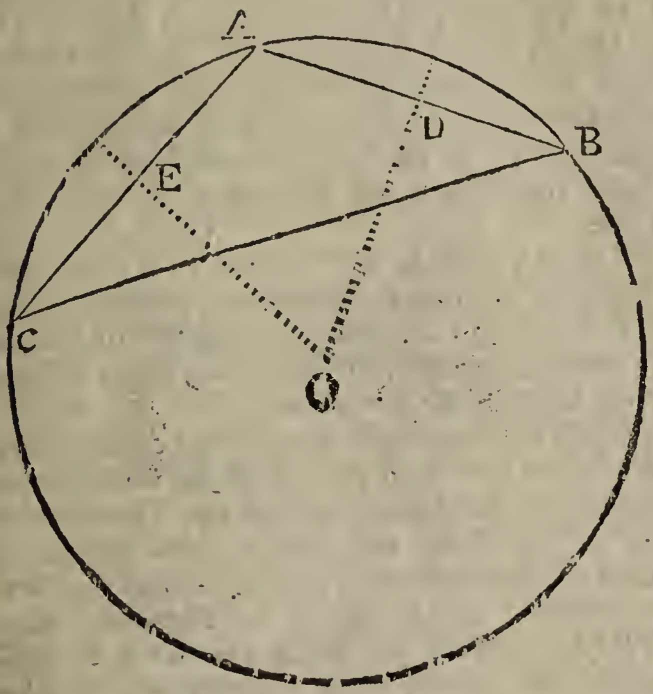
For the Triangle *a b c* is an *Iſoſceles* (becauſe *e a* = *b a*) and therefore the Perpendicular *a d* biſects the *Baſe*, or *Chord*, *b c* (10. e. 1. *Eucl.*) and conſequently the Ark *b c* is alſo by this means biſected. From whence are deducible and demonſtrable, theſe

PROBLEMS.

1. To make a Circle paſs thro' any three Points given, not lying in a Right-Line.
2. To find the Centre of any Circle.
3. To compleat a Circle from an Ark given.
4. To deſcribe a Circle about any Triangle given.

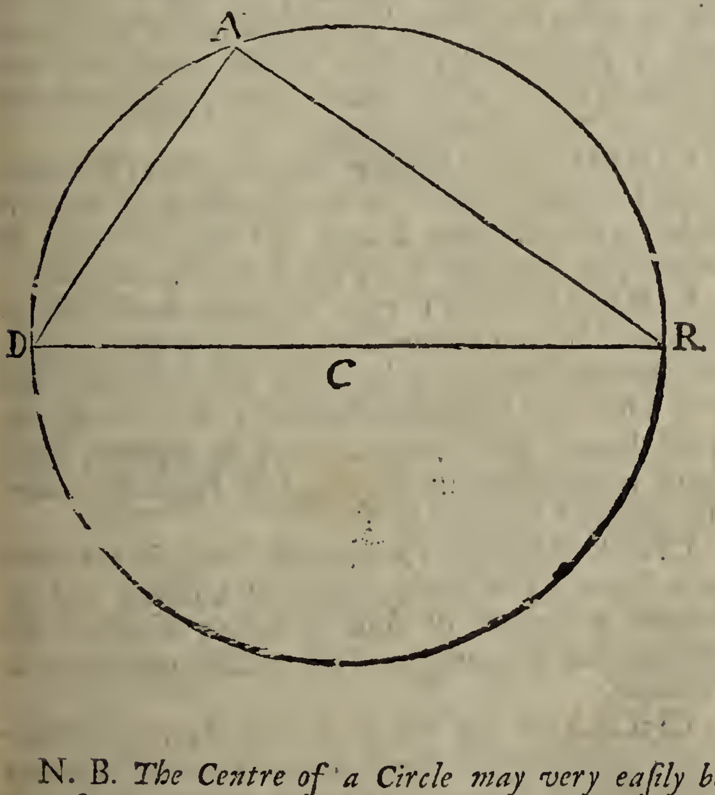
1. Let the three Points be A B C; join A B, and A C, which biſect in D and E, by drawing the Perpendiculars D O and E O. The Point O, where they croſs one another, muſt be the Centre, becauſe they both paſs thro' it by this Propoſition.

With the Diſtance A O draw the Circle, and the Demonſtration will be plain.



2. If the Circle had been given, or any Part of it, as ſuppoſe the Ark C A D, and the Centre of the Circle had been required, you need only mark out any three Points in the Circumference; as ſuppoſe A, B, C, then proceed as before, you'll find the Centre C.

3. The ſame way alſo you may deſcribe a Circle about the Triangle A B C; for the Perpendiculars that biſect any two Sides of the Triangle, will, where they croſs, find the Centre C, from whence a Circle being drawn, it ſhall circumſcribe the Triangle A B C. The Demonſtration is the ſame with the former.



N. B. *The Centre of a Circle may very eaſily be found by the Square, thus: Apply the Corner of the Square any where to the Circumference, as ſuppoſe at* A, *and draw* D R *between the Points, where the Legs cut the Circumference. The Line biſected ſhall give* C *the Centre of the Circle; for the Angle* D A R *being a Right one,* D R *muſt be the Diameter, by* 31. e. 3. Eucl. *The Half of which,* D C *or* C R, *muſt be the Radius.*

CHORDS [of Χορδὴ, *Gr.* a *Gut*, of which Strings are made] Strings.

On all plain Scales, and particularly on the Sector, there is a Line drawn called *The Line of Chords*, whoſe Uſes are very numerous: As,

1. *To meaſure the Quantity of an Angle plain given.*

With 60 of the Chords, and one Foot of the Compaſſes in the Vertex of the Angle, ſtrike an Arch between the Legs of the Angle, and then taking that Arch in the Compaſſes, and applying the Length of the Chord which ſubtends it to the ſame Lines of Chords, you will find the Quantity of the Angle by the Numbers there placed.

2. *By the Chords on the Sector to divide any Circle into its proper Degrees, and to meaſure the Quantity of an Arch of a given Circle.*

Apply over the Radius of the Circle, between 60 and 60 in the Lines of Chords; and then, if you take out the parallel Chords of one Degree, *&c.* and apply them to the Circumference of the Circle given, they ſhall divide it into its proper Degrees: And the Degrees of any Arch ſhall be known by entering the Diſtance between its Extremities in the Sector, parallel to the Radius between 60 and 60; or, by ſo applying it into the Sector, that it fall on the ſame Numbers on each Leg.

3. *To divide the Circumference of a Circle into any Number of equal Parts, or to inſcribe any regular Figure in a Circle.*

Divide 360 by the Number of equal Parts required, or by the Number of the Sides of the regular Polygon, and the Quotient will be a Number of Degrees, whoſe Chord applied round the Circumference will divide it as requir'd: As if you would divide any Circle into 32 equal Parts, ſet the Sector to the Radius, and then dividing 360 by 32, the Quotient is 11°, 15′; the Chord of which taken off parallelly, will divide the Circle into 32 equal Parts, or, into the Points of the Mariners Compaſs.

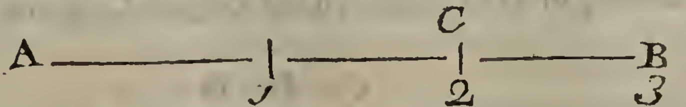
CHORDS *in Muſick* [of Χορδαὶ, *Gr. Strings*, a Name which Phyſicians give to the Inteſtines, becauſe the Strings of Muſical Inſtruments were (anciently) uſually made of Guts] are the Strings or Lines, by the Vibrations of which the Senſation of Sounds is excited, and by the Diviſions of which the ſeveral Degrees of Tune are determined.

Mr. *Perrault* takes notice, that of late times they have invented a Way of changing the Chords, in order to render their Sound more ſtrong, without altering the Tone.

The ſixth Chord of Baſs-Viols, and the Tenth of large Theorboes conſiſt of 50 Threads, or Guts, ſome of which are 100 Foot long, twiſted and poliſhed with Horſe-tail.

For the Diviſion of Chords, ſo as to conſtitute any given Interval, the Rules are as follow:

1. To aſſign ſuch a Part of a Chord A B as ſhall conſtitute any Chord; *v. g.* a Fifth, or any other Interval with the whole.

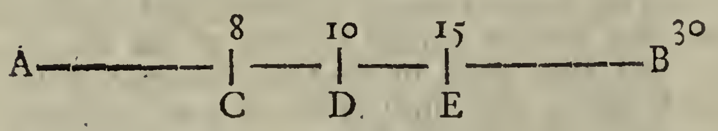


Divide A B into as many Parts as the greateſt Number of the Interval has Units, *e. g.* the 5th being 2 : 3, the Line is divided into 3; of thoſe I take as many of the leſſer Number, *v. g.* 2 = AC; AC is the Part ſought; that is, 2 Lines whoſe Lengths are to each other as A B to A C, make a Fifth.

Hence if it be required to find ſeveral different Sections of the Line A B, *v. g.* ſuch as ſhall be Octave 5th and 3d *g.* I ſhall reduce the given Ratio's 1 : 2, 2. 3, and 4 : 5, to one Fundamental, the Series becomes 30 : 24, 20 = 15, the Fundamental is 30, and the Sections ſought are 24, the third 9, 20, and the 5th and 15th the Octave.

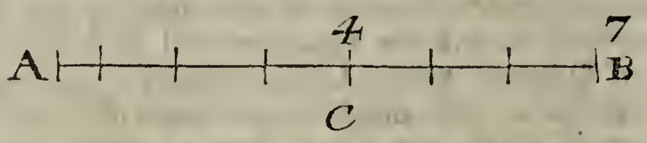
2. To find ſeveral Sections of a Line A B, that from the leaſt gradually to the whole, ſhall contain a given Series of Intervals in any Order, *viz.* ſo that the leaſt next to the greater contain a third *g*, that to the next greater a 5th, and that ~~to~~ the whole an Octave.

Reduce the three Ratio's 4 : 5, 2 : 3, 1 : 2 to one Series, hence we have 8 : 10 : 15 : 30.



Divide the Line into the Number of Parts of the greateſt Extreme of the Series, *viz.* 30, we have the Sections ſought at the Points of the Diviſion, anſwering the ſeveral Numbers of the Series, *viz.* at the Points C D and E; ſo that A C to A D is a 3d, A D to A E is a 5th, to A B an Octave.

3. To divide a Line A B into two Parts to contain between them any Interval, *v. g.* a Fourth.



Add together the Numbers containing the Ratio of the Interval, *v. g.* 3 : 4, and divide the Line into as many Parts as the Sum, *v. g.* 7, the Point of Diviſion anſwering to any of the Numbers given, *v. g.* 4 or C, gives the thing ſought.

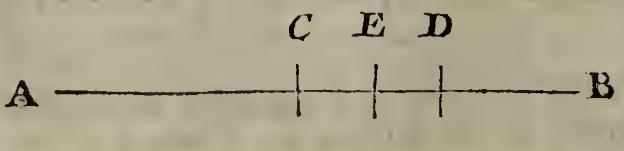
4. For the harmonical Diviſion of *Chords*, to find two Sections of a Line, which with the whole ſhall be in harmonical Proportion with regard to their Quantity.

Take any three Numbers in harmonical Proportion, as 3 —— 4 —— 6; and divide the whole Lines into as many Parts as the greateſt of theſe three Numbers, *v. g.* 6; and at the Points of Diviſion anſwering the other two Numbers, *v. g.* 3 and 4, and you have the Number ſought.

5. To find two Sections of a Line, which, together with the whole, ſhall be harmonical with reſpect to Quantity or Tone,

Take any three Numbers concord with each other, *v. g.* 2, 3, and 8, and divide the Line by the greateſt, the Points of Diviſion anſwering the other, give the Sections ſought.

6. To divide a *Chord* A B in the moſt ſimple Manner, ſo as to exhibit all the original Concords.



Divide the Line into two equal Parts at C, and ſubdivide the Part C B into equal Parts at D; and again, the Part C D into two equal Parts at E: Here A C to A B is an Octave, A C to A D a 5th, A D to A B a 4th, A C to A E a 3d, AE to A D a 3d, D C A E to E B a 6th *g*, AE to A B a 6th *g*.

Chord is alſo uſed in Muſick for the Note or Tone to be touched or ſounded, in which Senſe it is applicable to all the Intervals of Muſick. — In this Senſe the Fifth is ſaid to conſiſt of five *Chords* or Tones.

CHORDA [Χόρδη, *Gr.*] a Bowel, a Gut; alſo the String of a Muſical Inſtrument, made of a Gut.

CHORDA [in *Anatomy*] a Tendon or Nerve; alſo a painful Extenſion of the *Penis*, when its Head is drawn towards the *Perinæum.*

CHORDA *Membranæ Tympani* is a certain Nerve coming from the third Branch of the fifth Pair, extended above the Membrane of the *Tympanum* or Drum of the Ear, and which goes alſo to the Muſcles of the *Malleolus*, and then joins the *Portio Dura* before it comes out of the *Cranium.* *L.*

CHORDAPSUS [of Χορδαψὸς, *Gr.*] ſo *Celſus* names it, barbarouſly called *Miſerere mei*, by others *Iliaca Paſſio*, by others *Volvulus*, commonly *Ileus*, is an Ejection of the Excrements at the Mouth only, becauſe the *Periſtaltick*, or Vermicular Motion of the Guts, whereby the Excrements are excluded, becomes inverted. *Blanchard.*

CHOREA *Sancti Viti*, is a ſort of Madneſs which formerly was very common amongſt ſome People, wherein the Perſon affected lay not down, but ran hither and thither dancing to the laſt Gaſp, if they were not forcibly hindered. *Horſtius* ſays, That he hath ſpoke with ſome Women, who paying a yearly Viſit to the Chapel of Saint *Vitus*, which is near the City *Ulme* in *Sweedland*, have been taken with ſuch a violent Fit of Dancing Night and Day, together with a ſort of Franticknefs in the Mind, that they fall together like ſo many People in Extaſies, and are ſenſible of little or nothing for a Year together, till next *May*, about which time they perceive themſelves ſo tormented with a Reſtleſneſs in their Limbs, that they are forced to repair to the ſame Place again about the Feaſt of Saint *Vitus* to dance. *L.*

CHOREUS [of Χορεῖος] vulgarly called *Trocheus*, is the Foot of a *Latin* Verſe, conſiſting of two Syllables, where the firſt is long and the laſt ſhort, as *Annus*; ſo that this is the Reverſe of an *Iambus.*

CHOREPISCOPI were anciently rural Biſhops delegated by the prime Dioceſan; but their Authority became reſtrained by ſome Councils, and this very Office by Degrees aboliſhed; after whom the rural Deans were commiſſioned to exerciſe Epiſcopal Juriſdiction, till inhibited by Pope *Alexander* III. and the Council of *Tours.*

CHORIAMBUS [Χοριάμβος, *Gr.*] is the Foot of a *Latin* Verſe compounded of a *Chorus* and an *Iambus*, it conſiſts of four Syllables, of which the firſt and laſt are long, and the middle one ſhort, as *Hiſtoriæ.*

CHORION [of Χόριον, *Gr.*] is the outer Membrane involving the *Fœtus* in the Womb; 'tis pretty thick, ſmooth within, but rough on the out-ſide, to which the *Placenta* adheres: It hath many Veſſels which ſpring from the *Placenta*, and from the Umbilical Veſſels. The former are diſperſed thro' it before the *Fœtus* is ſhaped (as *Diemerbroeck* affirms) but the latter not till the Navel-Rope is grown out to a juſt Length, at which time they enter in it, and are intermixt with the former, and from this Membrane are inſerted into the *Placenta*, to which the *Chorion* adheres. This Membrane, the *Chorion*, is always ſingle, tho' the *Fœtus* be Twins, tho' then there is a double *Amnion*, treble, quadruple, *&c.* if the *Fœtus* are 3, 4, *&c.* Originally the *Chorion* did inveſt the *Ovum*, but when that is brought down into the Womb, and is become a Conception, this Membrane imbibes the Moiſture of that Part very plentifully; for while the Conception lies looſe there, and is faſtened to no Part by any Veſſels which go from it, or come to it, it ſeems to have its Increaſe juſt as the Egg hath in the Body of the Hen; which, whilſt it is in the *Racemus* or Knot, hath no other Subſtance but the Yolk; and when it drops off from thence, and deſcends thro' the *Infundibulum*, it receives no Alteration; but when it comes into the Cells of the Proceſs of the *Uterus*, it begins (ſaith *Harvey*) to gather a White, altho' it yet ſtick to no Part of the *Uterus*, nor hath any Umbilical Veſſels; but, juſt as the Eggs of Frogs and Fiſhes gather themſelves a White out of the Water, ſo doth there come out of the *Plicæ* or Wrinkles of the Womb, an Albugineous Moiſture, whence the Yolk [by its vegetative and innate Heat] gathers and concocts its White. After this Manner doth the *Chorion* imbibe that Albugineous Matter, which from the firſt Conception increaſes daily in it (and which tranſudes thro' the *Amnion* in which the *Embryo* ſwims) till the Umbilical Veſſels and the *Placenta* are formed, from and thro' which the *Fœtus* may then receive its Nouriſhment: And the Liquor which this *Chorion* imbibes, Dr. *Gibſon* takes to be the Nutritious Juice which ouzes into the Cavity of the *Uterus*, out of the Capillary Orifices of the Hypogaſtrick and Spermatick Arteries, and is of the ſame Nature with that which is afterwards ſeparated in the *Placenta*, and carried to the *Fœtus* by the Umbilical Vein, and with that alſo which abounds in the *Amnion*, even 'till the Birth: For the Plaſtick or Vegetative Virtue is only in the *Ovum* itſelf, and the Augment that the firſt Lineaments of the *Fœtus* receives, is only by Appoſition of this Nutritious Juice: But the *Chorion* is grown ſo denſe and thick by that time the *Placenta* and Umbilical Veſſels are formed, that it is not capable of imbibing more, but that which in this time is in it, doth in a little while tranſude into the *Amnion*, and ſo itſelf becomes empty, and gives way to the Encreaſe of the *Allantoides* (which from hence begins to appear) and whoſe Liquor encreaſes daily, as the *Fœtus* grows near to the Birth. This Opinion, which ſeems indeed very probable, the Learned Dr. *Gibſon*, in his *Anatomy* (laſt Edition, *p.* 220) propoſes only as a Conjecture, and ſubmits it to the Cenſure of the Learned.

CHOROBATES [of Χοροβάτειν, *Gr.* to *over-run a Country*] a kind of Level uſed among the Ancients, compoſed of a double Square, made in form of a Tree, deſcribed by *Vitruvius.*

CHOROGRAPHY [of Χορογραφία of Χορος and γράφω, *Gr.* to *deſcribe*] is a particular Deſcription of ſome Country, as of *England*, *France*, or any Shire or Province in them, *&c.*

CHOROIDES is the fourth Coat of the Eye, lying under the *Sclerotick*, it hath many little Glands which ſeparate a black Liquor, which tinges the Inſide thereof; otherwiſe of a white Colour, in order to hinder the reflected Light from diſturbing or confounding the Pictures of Objects from being truly repreſented on the *Retina*. This Coat hath a Hole before, which is called the *Pupilla*, which ſerves to admit Light and Colours into the Eye, its inner concave Surface very ſmooth and polite; it is black in Mankind, but of a ſhining Colour, like the Brilliant of Silver, or the Luſtre of Oriental Pearl in many Animals, as Bears, Camels, Cattle, Cats, Dogs, Lyons, Sheep, *&c.* and alſo in moſt Fiſhes, and makes what Naturaliſts call the *Tapis*, or Colour of the Eye.

CHRISM was anciently (in times of Popery) a Confection of Oil and ſweet Balſam, which was conſecrated by the Biſhop, and uſed in Baptiſm, Confirmation, Extreme-Unction, *&c.*

CHRISOM *Chriſmale* was the Face-cloth, or Piece of Linen, laid over the Child's Head when it was baptized; whence, in our weekly Bills of Mortality, ſuch Children as die in the Month are called *Chriſoms.*

CHROMATICK [of Χρωματικὸς, *Gr.*] a Term in *Muſick*, being the ſecond of the three Kinds, which abounds in Semi-tones, and contains only the leaſt *Diatonical Degrees.* It is recorded in Hiſtory, That *Timotheus* the *Mileſian* firſt invented this ſort of Muſick in the time of *Alexander the Great*, and the *Spartans* baniſhed him, becauſe, being accuſtomed only to the *Diatonick* kind, they judged the *Chromatick* to be too ſoft.

CHROMATICK [with *Painters*] a Term uſed for the Colouring, which makes the third Part in the Art of Painting.

CHRONICK, CHRONICAL *Diſeaſes*, [Χρονικὸς of Χρόνος, *Gr. Time*] a Term applied to ſlow and inveterate Diſeaſes, which laſt a long time, as the *Gout*, *Hæmorrhoids*, *Fiſtula*, *Dropſy*, *Aſthma*, *&c.* they are oppoſed to *acute* Diſeaſes, which are ſpeedy, and haſten to a *Criſis*, as *Fevers*, *Small-pox*, *&c.*

CHRONODIX [of Χρόνος and δείκνυμι, *Gr. to ſhew*] a ſort of Dial or Inſtrument to ſhew the paſſing away of Time.

CHRONOGRAM [Χρονογράμμα, of Χρόνος and γράμμα, *Gr.* a *Letter*] a ſort of Verſe, the figurative or numeral Letters whereof being computed into one Sum, make up the Year of our Lord, *&c.*

CHRONOLOGY [Χρονολογία, of Χρόνος, *Time*, and λέγω, *Gr.*] in the common Senſe of the Word now, is the Arithmetical computing of Time for Hiſtorical Uſes, ſo as thereby truly to date the Beginnings and Ends of Princes Reigns, the Revolutions of Empires and Kingdoms, Battles, Sieges, or any other memorable Actions. Authors on this Subject are:

J. Bap. Riccioli Chronologia Reformata. 2 Tom. Bonon. 1669.
Guil. Beveregii Inſtitutiones Chronologicæ.
Mar. Boxhornii Chronologia.
Sethi Caluiſii Opus Chronologicum.
Alſtedii Theſaurus Chronologicus.
Meſlini Chronolog. Theſæ & Tabulæ.
Helvici Chronologia.
Joſ. Scaliger de Emendatione Temporum.
Suranchii Chronolog.

CHRONOMETRUM [of Χρόνος and μετρεῖν, *Gr. Meaſure*] *Perpendiculum*, or *Chronoſcopium*, the ſame as *Pendulum*; which ſee.

CHRONOSCOPE [of Χρό ος and σκοπέω, *Gr. to view*] the ſame with a Pendulum to meaſure Time. See *Pendulum.*

CHRYSALIS is a Term uſed by the modern Writers of the *Natural Hiſtory of Inſects*, for the ſame with *Nympha*; which ſee. Indeed the Word, as well as that *Aurelia* uſed in the ſame Senſe, ſeems to imply a peculiar Yellow or Golden Colour in the *Nympha*; but this is purely accidental, and is by no means found in all *Nymphæ*, tho' ſome confine

fine this Word *Chryſalis* to the *Nymphæ* of *Butterflies* and *Moths* only. See *Swammerdam Hiſt. Inſect. general.* Sect. 2.

CHRYSOCERAUNIUS *Pulvis* is the ſame with *Aurum Fulminans*; which ſee.

CHRYSTAL *Mineral.* See *Sal Prunellæ.*

CHRYSTALS *of Copper.* See *Vitriol of Copper*, or *Venus.*

CHRYSTALS *of Silver*, or *Vitriol of the Moon*, is an Operation in *Chymiſtry* whereby the Body of Silver is opened and reduced into the Form of a Salt by *Spirit of Nitre.* 'Tis done thus: Diſſolve an Ounce or two of Silver in about three times the Weight of *Aqua Fortis*, or, which is better, good *Spirit of Nitre*; evaporate the Diſſolution in a Glaſs-Cucurbite, and over a Sand-heat, till about one Fourth of the Liquor is blown off, then let the Remainder ſtand without ſtirring it, and it will ſhoot into Chryſtals, which take out, and when they are dry, keep them in a Phyal well ſtopt. Theſe *Chryſtals* are uſed to make an Eſchar, by touching any Part with them. They are alſo given inwardly in Dropſies ſometimes, from two to ſix Grains, and they will purge gently. The purgative Quality in theſe *Chryſtals* (there being no ſuch thing either in the Silver or the Spirit of Nitre) muſt ariſe from the new Texture and Conformation of the Parts of both, happening from this Union of the Parts of the Silver with thoſe of Spirit of Nitre.

Theſe *Chryſtals* may eaſily be *revived* into good Silver again, if you put them to diſſolve, as they will readily do in a Veſſel of hot Water, in the Bottom of which you ſhall have laid a Plate of Copper, the Silver will precipitate down in a white Powder, which gather, waſh, and dry, and then melt it in a Crucible with a little *Salt Petre*, 'twill run into good Silver of the ſame Weight, as at firſt.

CHRYSTALS *of Tartar.* See *Cream of Tartar:*

CHRYSTALLINE *Heavens* [in the *Ptolemaick Syſtem*] were two: *One* ſerved them to explain the ſlow Motion of the fixed Stars, and cauſed them (as they thought) to move one Degree Eaſtward in about 70 Years.

The *ſecond* helped them out in ſolving a Motion, which they called *The Motion of Trepidation*, or *Libration*, by which they imagined the Sphere to ſwag from Pole to Pole.

CHRYSTALLINE *Humour of the Eye.* See *Humours.*

CHRYSTALLIZATION is an Operation in *Chymiſtry*, by which the Salts diſſolved in any Liquor are made to ſhoot into little prettily figured Lumps or Fragments, which they call *Chryſtals*, from their being pellucid or clear like Chryſtal.

In order to bring the Salts duly to *Chryſtallize*, you muſt gently evaporate Part of the Moiſture; for if there be too much Liquor in Proportion to the Salt, it will not coagulate or chryſtallize at all; and if there be too little, the Salts will all run into one another, and not chryſtallize regularly. The general Rule to know when enough of the Moiſture is evaporated, is when a little Skin begins to be on the Surface of the Liquor.

CHURCH-*Scot*, *Payment*, or *Contribution*, by the *Latin* Writers, was frequently called *Primitiæ Seminum*, becauſe it was at firſt a Quantity of Corn paid to the Prieſt on St. *Martin's* Day, as the firſt Fruits of Harveſt. This was enjoined by the Laws of King *Ina*, *c.* 4. and by *Canute*, *c.* 10; but after this it came to ſignify a Reſerve of Corn-Rent paid to the Secular Prieſts, or to the Religious; and ſometimes was taken in ſo general a Senſe, as to include Poultry, or any other Proviſion, that was paid in kind to the Religious.

CHYLE is a white Juice in the Ventricle and Inteſtines, proceeding from a light Diſſolution and Fermentation of the Victuals, eſpecially of the Sulphur and Salt with which edible things abound, and which, by the Invention of the acid Humour in the *Ventricle*, becomes white; for if you pour in *Acid* upon any Liquor that is impregnated with Sulphur and Volatile Salt, it preſently turns milky, as is obvious in preparing Milk of Sulphur, or the reſinous Extracts of Vegetables: Nay, *Spirit of Harts-horn* and of *Soot*, abounding with Volatile Salt, if it be mix'd with an Acid, or with but plain Water, grows to be of a milky Colour: At laſt the *Chyle*, after a Commixtion and Fermentation with the *Gall*, and the *Pancreatick Juice*, either Volatile or Acid, paſſing the *Lacteal Veins*, &c. is mixed with the Blood. It is called in *Latin* alſo *Chymus.* *Blanchard.*

As to the Manner how this *Chyle* is firſt made and perfected, ſee

CHYLIFICATION, which is the Action of the Stomach, Guts, &c. in the making of *Chyle*; and 'tis done thus, as I find the acurate Mr. *William Cowper*, Chirurgeon, hath accounted for it in a Paper publiſhed in *Philoſoph. Tranſ. N.* 220.

The Aliment which is uſually taken down into the Stomach of adult Perſons, is ſuch whoſe Groſſneſs of Parts requires Maſtication or Chewing; in order to which, the *Dentes Inciſores* are ſometimes employ'd to divide it from the more bulky Part, and to receive it into the Mouth; and then the lower Jaw being variouſly moved by its proper Muſcles, Maſtication is begun, and carried on by the Aſſiſtance of the Tongue, Cheeks, and Lips, the two firſt ſtill applying the leſs divided Parts of the Aliment to the *Dentes Molares*, 'till there is an equal Comminution of all its Parts; nor is the Action of Maſtication merely performed for dividing the groſſer Parts of the Aliments, but divers of the Muſcles employed in the Motion of the lower Jaw are at the ſame time alſo ſerviceable in haſtening the *Saliva* or Spittle, ſeparated from the Blood by the Parotid Glands; thoſe of the lower Jaw, and under the Tongue, into the Mouth; the *Saliva* Glands of the Cheeks and Lips alſo contributing their Juice, do all together join with the maſticated Aliments, before or at the ſame time 'tis made fit to be ſwallowed; which Action is called *Deglutition.*

Deglutition is thus performed: The Aliment, as well what's fluid as that maſticated, being lodged on the Tongue, which does ſomewhat hollow itſelf by means of its own proper muſcular Fibres, for the more commodious entertaining the larger Quantity, its Tip and Sides are applied to the Indices of all the Teeth of the Upper-Jaw (and *Ginigivæ* or Gums of thoſe that want Teeth) the Tongue is ſuddenly drawn up by the *Muſculi Stylogloſſi*, or *Mylogloſſius*, together with thoſe Muſcles which pull the *Os Hyoides* upwards; at the ſame time the *Fauces* are drawn up, and their Cavity enlarged by the *Muſculi Stylopharingæi*; and about two Thirds of the Tongue's ſuperior Surface is adequately applied to the Roof of the Mouth; the *Epiglottis* from its Poſition being conſequently depreſſed, does thereby cover the *Glottis* or *Rimula* of the *Larynx*, and prevents any Part of the Aliment from deſcending into the Wind-pipe: In this Part of the Action of *Deglutition*, the Glands under the Tongue, and excretory

cretory Ducts of thoſe of the lower Jaw, are compreſſed, and their ſeparated Liquors or Spittle voided by their *Papillæ*, ſituated at the lower Part of the *Frænum* or Ligament of the Tongue; and this is done by the *Muſculus Mylo-Hyoidæus*, when the Aliment, by the above mentioned Motion of the Tongue is forced into the *Fauces* or Upper-part of the *Gula*; at the ſame time the *Gargareon*, together with the *Uvula*, are drawn upwards by the *Muſculi Sphænoſtaphili*, by which Means any Part of the Aliment is hindered from aſcending into the *Foramina Narium*: The *Fauces* by the *Muſculus Pterygopharyngæus* and *Oeſophagus* are contracted, whereby the Aliment is not only compreſſed into the *Gula*, but the Matter ſeparated from the Blood by the Glands of the *Fauces*, eſpecially of thoſe large ones called *Tonſillæ*, is forced out of their Cells, or excretory Ducts, to join with it in its Deſcent to the Stomach by the *Gula*, thro' which the latter paſſes by the Action of its *Muſcular Fibres*.

The Aliment thus impregnated with *Saliva* in Maſtication and Deglutition, being received into the Stomach, there meets with a Juice ſeparated from the Blood by the Glands of that Part, whoſe excretory Ducts open into the Cavity of the Stomach. By the Commixture of theſe Liquors, whether of *Saliva* or the Juice of the Stomach, a proper *Menſtruum* is compoſed, by which the Parts of the Aliment are ſtill more and more divided by its inſinuating into their Pores, and by which the Air, before impriſoned in their leſs-divided Parts, is not only ſet more at Liberty, but by the natural Heat, it muſt neceſſarily ſuffer ſuch a Rarefaction, as that thereby the whole Stomach becomes ſtill more and more diſtended; hence it is we have leſs Appetite ſome time after eating (when this Intumeſcency is made) than we had immediately after; hence alſo ariſe thoſe frequent *Eructations* from divers Aliments, as, old Peaſe, Cabbage, and divers other Vegetables we frequently eat; all which becomes very much diſturbing in depraved Appetites and weak Stomachs.

Tho' we have not uſed the Word *Fermentation*, yet we do not ſuppoſe the Diſſolution of the Aliment within the Stomach can be done, at leaſt without an inteſtine Motion of its Particles with the *Menſtruum*; but we have omitted that Term, becauſe it may be apt to lead us into an Idea of a greater Conflict than in truth there really is.

At the ſame time of this Intumeſcence, an Agitation of the Matter is made in the Stomach, the Contents of the neighbouring excretory Ducts, namely, the Bile in the Gall-Bladder and Liver-Ducts, and Pancreatick Juice in the *Ductus Pancreaticus*, are compreſſed into the *Inteſtinum Duodenum*, thro' the Extenſion of the Stomach itſelf, the refluent Blood of the Stomach at that Inſtant being in ſome meaſure retarded, whereby the Muſcular Fibres are more liable to be contracted.

Nor can we conceive how the Liquor of the Stomach, after having joined with the *Saliva* and Aliment, ſhould be ſtill ſo plentifully excreted from the Glands of that Part, as to irritate its internal Membrane, and excite its Muſcular Fibres to contract, ſince the Muſcles of the *Abdomen* would, like as in Vomiting, be drawn into a Conſent of co-operating, and the Aliment would be forcibly rejected by the Mouth: Beſides, ſhould the Liquor of the Stomach be ſo diſturbed in Chylification, what would it be ſo ſoon as all its Contents were diſcharged? The Irritation the Stomach undergoes in Hunger, we are firmly perſuaded, does not ariſe but thro' an Accumulation of the *Saliva* in the Stomach, in Conjunction with the Liquor of the Glands of that Part; whence it is we rather diſcharge the Spittle at that time by the Mouth, than to ſuffer any more of it to deſcend into the Ventricle; hence proceeds what we call *The watering of the Mouth*: Hence alſo, when the *Saliva* is vitiated, the Appetite is depraved.

The Stomach, by means of its *Muſcular Fibres*, contracting itſelf, does gradually diſcharge its Contents by the *Pylorus* into the *Duodenum*, in which Gut, after a ſmall *Semicircular* Deſcent, it meets with the Pancreatick Juice and Bile; both which joining with it, renders ſome Part of the Aliment more fluid, by ſtill diſuniting the groſſer Parts from the more pure; and here *Chylification* is made perfect.

The Bile which abounds with lixivial Salts, and apt to intangle with the groſſer Parts of the concocted Aliment, ſtimulates the Guts, and deterges or cleanſes their Cavities of the *Mucous Matter*, ſeparated from the Blood by the Glands of the Guts, and lodged in their Cavities, which not only moiſtens the Inſides of the Guts, but defends the Mouths of the lacteal Veſſels from being injured by *Alien Bodies* which often paſs that Way.

The Contents of the Inteſtines moving ſtill on by means of the Periſtaltick or Worm-like Motion of the Guts, whilſt thoſe thinner Parts fitted for the Pores of the lacteal Veſſels called *Chyle*, are abſorbed by them, the thicker move ſtill more ſlowly on, and, by the many Stops they continually meet with by the *Connivent Valves*, all the *Chyle*, or thin Parts, are at length entirely abſorbed, the Remains being merely excrementitious, are only fit to be excluded by Stool.

The analogous white Appearance of the *Chyle*, whether in the Stomach or Inteſtines, and always in the *Venæ Lacteæ* and *Thoracick Duct*, may be ſeen in the Commixtures of divers Liquids, which ſeparated exhibit no ſuch Appearance; nor is this *Phænomenon* any otherwiſe than a Tranſpoſition of Particles, whether by a *Menſtruum* inſinuating into them, dividing them into groſs Globules, as an Acid into Sulphur, as Vinegar with Oil, *&c.* or elſe by Precipitation, as when a gummous or reſinous Body is diſſolved in a ſpirituous *Menſtruum*, and mixed with a Phlegm; ſo Tincture of Myrrh and Benjamin, *&c.* make a milky Appearance in common Water.

The longitudinal and tranſverſe Order of the Fibres of the Guts, are the Inſtruments by which the periſtaltick Motion of them is performed, which Motion is not only neceſſary for puſhing their Contents forwards, but by reciprocal Contraction of the Muſcular Fibres of the Guts, and Appoſition of their *Connivent Valves*, the Mouths of the Lacteals are diſpoſed to receive what is fitted for them; hence it is we can by no means make any Fluid whatever paſs from the Cavity of the Guts into thoſe lacteal Veſſels in a dead Animal.

A further Uſe of this Contraction of the *Muſcular Fibres* of the Inteſtines, is to accelerate the *Chyle* in its Progreſs in the Lacteals, 'till the *Lympha* derived from the Extremities of the Arteries of the Guts joins with it; which Conjunction is made in the *Lacteals* before they leave the external Surface of the Inteſtines. By this means the Progreſſion of the *Chyle* is made towards the Meſenterick Glands, into whoſe Cells it is received, where it again mixes with a Juice brought in by the Arteries of each Gland; which Juice, or Lymphatick Liquor, not only farther dilutes the *Chyle*, like that from the Arteries of the Inteſtines, but adds a freſh *Impetus*, by which its Motion is farther carried on thro' the *Vaſa Lactea ſecundi generis* ; (ariſing out of each Meſenterick Gland, and diſcharging their Contents into the *Receptaculum Chyli*). Here the *Chyle* meets and joins with the *Lympha* ſent thro' the *Lymphatick Ducts* from the inferior Limbs and neighbouring Parts, whereby the *Chyle* is not only farther prepared, but its Aſcenſion is promoted in the Thoracick Ducts, whoſe ſeveral Diviſions and Inoſculations (like the Veins of the Teſticles) with its many Valves looking from below upwards, and advantageous Situation between the great Artery and *Vertebræ* of the Back, together with the Lymphe-ducts, diſcharging their *Lympha* derived from the Lungs and neighbouring Parts of the Thorax, does demonſtrate the utmoſt Art ſtill uſed in order to its Aſcenſion towards the Left Subclavian Vein, where meeting with the refluent Blood of the ſuperior Parts, it paſſes with it thro' the deſcending Trunk of the *Vena Cava*, and joins with the refluent Blood of the inferior Parts in the Right Auricle of the Heart; whence 'tis expelled by its Contraction into the Right Ventricle, when the Heart is in a *Diaſtole* ; but by the *Syſtole* or Contraction of the Heart, 'tis again driven out thence into the *Arteria Pulmonaris*, thro' whoſe Extremities, in Conjunction with thoſe of the *Vena Pulmonaris*, it paſſes to the Left Auricle and Ventricle of the Heart, from whence it is again expelled in the *Syſtole* (as above) into the *Aorta* or *Arteria Magna*, by whoſe Branches 'tis conveyed thro' the whole Field of the Body. The three tricuſpid Valves in the Right, and two mitral Valves in the Left Ventricle of the Heart oppoſing its Return into the Veins, and the ſemilunary Valves of the *Arteria Pulmonaris* and *Aorta* preventing its Ingreſs into the Ventricles, are ſufficient (when rightly conſidered) to demonſtrate the Neceſſity of a Circulation of this grand Fluid called *Blood* : Thus *Sanguification* is begun, and as we have mentioned the divers Preparations of the Aliment before Chylification, ſo here may be obſerved the various Mixtures and Preparations of *Chyle*, in order to Sanguination.

CHYROGRAPHUM [in the *Saxon* times] ſignified any publick Inſtrument of Conveyance atteſted by Witneſſes : This the *Normans* called *Charta*.

To prevent Frauds and Concealments, they made their Deeds of mutual Covenant in a *Script* and *Reſcript*, or in a *Part* and *Counter-part*, upon the ſame Sheet of Paper or Parchment ; and in the Middle, between the two Copies, they draw the Capital Letters of the Alphabet, or ſometimes the Word *Syngraphies* in the like great Letter, and then *talliated* or cut the ſaid Sheet aſunder in an indented Manner, which being delivered to the two Parties concerned, were proved authentick by matching with or anſwering to one another, like our preſent Indentures, or like Tallies in Wood. And when this prudent Cuſtom had for ſome time prevailed, the Word *Chirographum* was appropriated to ſuch *bipartite Writings*.

CHYLI *Receptaculum*. See *Receptaculum Chyli*.

CHYLIOSIS, the ſame with *Chylificatio*.

CHYMIA, or *Chemis*, [of Χύω, *Gr. to melt*] is a Reſolution of mixed Bodies in their Elements ; and again, when it can be done, *Coagulation* or Redintegration of the ſame Elements into the Bodies which they conſtituted before. There are two Parts of it, *Solution* and *Coagulation* : By the Addition of the *Arabick* Article, it is called *Alchymia*, or *Alkymia* ; it is called alſo *Spagyria*, *Hermetica ars*, *ars perfecti Magiſterii*, *ars Segregatoria*, *Separatoria*, and *Diſtillatoria*. *Blanchard*.

CHYMICA, or *Chymicalia*, are Medicines which the *Chymiſts* prepare, that they may be taken in a leſs or more grateful Quantity. *L*. *Blanchard*.

CHYMISTRY is variouſly defined, but the Deſign of the Art is, to ſeparate uſefully the purer Parts of any mix'd Body from the more groſs and impure. It ſeems probably to be derived from the *Greek* Word Χυμὸς, which ſignifies *a Juice*, or the purer Subſtance of a mixed Body ; tho' ſome will have it to come from Χαίνω, *to gape*. It is alſo called the *Spagyrick*, *Hermetick*, and *Pyrotechnick Art* ; as alſo, by ſome *Alchymy*. The Reaſons whereof you may ſee under thoſe Words.

CHYMOSIS, or *Chemoſis* [of Χέω, *to fuſe* or *melt*] is a Diſtortion of the Eye-lids, ariſing from an Inflammation ; alſo, an Inflammation of the *Cornea Tunica* in the Eye. *Blanchard*.

CHYMUS, the ſame with *Chylus*.

CHYRONIA is a great Ulcer, and of difficult Cure. See *Chironium Ulcus*.

CHYRURGERY [of Χεὶρ, *an Hand*, and ἔργον, *Gr. Work*] or, as 'tis now-a-days pronounced and written, *Surgery*, is the third Branch of the curative Part of Medicine, and teacheth how ſundry Diſeaſes of the Body of Man may be cured by *Manual Operation*. Some divide it into theſe five Parts : 1. *Syntheſis*, a ſetting together of things ſeparate. 2. *Diæreſis*, a ſeparating of things that were continued before. 3. *Diorthoſis*, a correcting of things ſqueezed together and contorted. 4. *Exæreſis*, a taking away of Superfluities. 5. *Anapleroſis*, a reſtoring of that which was deficient.

CICATRISANTIA are ſuch things as, by drying, binding, and contracting, fill up Ulcers with Fleſh, and cover them with a Skin. *L. Blanchard*.

CICATRICULA is that little whitiſh Speck in the Coat of the Yolk of an Egg, in which the firſt Changes towards the Formation of the Chick appear in an impregnated Egg: 'Tis commonly called the *Treddle*. The Chick lodged in the *Cicatricula* is nouriſhed only by the White of the Egg, till 'tis grown of a competent Largeneſs, the Yolk ſeeming to be reſerved by Providence for a more ſtrong and ſolid ſort of Aliment, which is fitter for the Animal when grown greater. *L*.

CICATRIX, *Cicatrices*, Scars or Marks which are left after great Wounds or Ulcers : Some are ſimple, others are accompanied with *Cavities*, Diminution or Excreſcence in the Parts affected. *L*.

CICATRIZING *Medicines*. *L*. See *Cicatriſantia*.

CILIA and *Supercilia* are the Eye-brows, hard cartilaginous Bodies ; but *Supercilia* properly the Hair upon the Eye-brows, at the Extremity of the Forehead. *L*.

CILIARE *Ligamentum*, or *Proceſſus Ciliaris*, is a Collection of ſmall ſlender Filaments which take their Riſe from the inner Part of the *Tunica Uvea* in the Eye, and thence run towards the prominent Part of the Chryſtalline Humour, which they compaſs in and connect to the *Uvea*. Its Uſe is to help, contract, or dilate the Figure of the Chryſtalline Humour, and to draw it farther from, or bring it nearer to the *Uvea*, according as Occaſion ſerves. *L*.

CIMA [in *Architecture*] is a Moulding ſomewhat reſembling an (*S*) *Vitruvius* makes it of two Quarter-Circles joined together. Our Workmen call it an O—G—.

CIMATIUM, CIMATUM [in *Architecture*] is what our Workmen call an O—G— with the

Hollow downwards; ’tis Part of the Ornament of the *Dorick* Capital; it ſtands juſt above the Square, and hath a Fillet over it.

CINCTURA [*Cinctura*, L. *a Girdle*] in *Architecture*, is that Part which makes the Middle of a Pillar; ’tis call’d *Conge* in *French*; the *Greeks* called it ἀποφύγη, becauſe that Part of the Pillar taking (as it were) a Riſe, ſeems to fly from the Baſis: It is no more than the Rings of Ferrils formerly uſed to preſerve Wooden Pillars from ſplitting, and which they afterwards imitated in Stone-Work.

CINEFACTION, with ſome Chymiſts, is uſed for *Calcination*. L.

CINERATION [with *Chymiſts*] is the Reduction of Wood, or any other combuſtible Matter, into Aſhes, by Means of Fire.

CINERES *Claviculati* [*Chymiſtry*] Aſhes made of Tartar, or the Lees of Wine burnt. *L.*

CINERITIA, or *Subſtantia Corticalis*, is the external Subſtance of the *Cerebrum*; it is ſoft and glandulous, and of an aſhy Colour. *L. Blanchard.* See *Cortical.*

CINNABAR is a Mixture of Sulphur and Quick-Silver ſublimed together, and is either natural, when this Mixture is made in the Earth by Means of the ſubterraneal Heat, and then ’tis called *Native Cinnabar*; or elſe ’tis artificial, which is thus made: The Sulphur is melted in a great Earthen Pan, and then is put into it, by Degrees, thrice its Weight of Mercury, and the Mixture is ſtirred about till all the Quick-ſilver diſappears: And after this, the Mixture is cooled and powdered, and then ſublimed in Pots with an open Fire, a hard red Maſs will be raiſed, ſhaped like Needles; ’tis browniſh when in the Lump, but being powdered finely, is of a very high Red, and is called *Vermilion.* The chief Deſign of this Operation is, to make the Mercury portable, which it is not ſafely when in its natural Form, becauſe of its great Weight and Fluidity.

Cinnabar is revived into Mercury by mixing with it, in Powder, three times as much Quick-lime, and diſtilling in a Glaſs Retort, into a Receiver filled with Water, by Degrees of Fire, the Quick-Silver will be found at the Bottom of the Receiver. You may receive Quick-ſilver alſo by mixing an equal Quantity of Filings of Iron with the *Cinnabar*, and diſtilling as before.

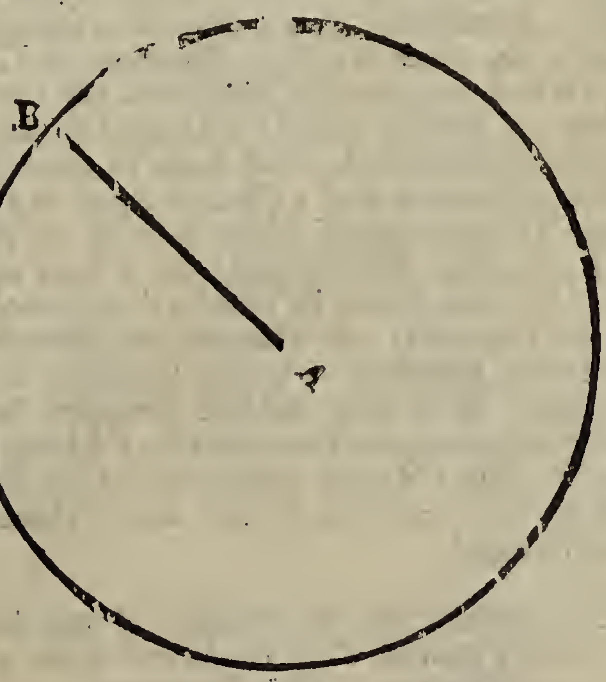
CINNABAR *of Antimony* is thus made: Fill a Retort half full of equal Parts of Powder of Antimony and Sublimate Corroſive, and ſetting the Veſſel in Sand, proceed at firſt as in the making of *Butter of Antimony*, which will alſo this way be made; but when, the Fire being encreaſed, you find red Vapours begin to ariſe, fit on another Receiver, but without luting the Junctures, and raiſe the Fire by Degrees till the Retort be red hot, in which State it muſt be kept three or four Hours; then the Veſſels being left to cool, break the Retort, and you will find, if the Operation ſucceed (which now and then it will not) the Cinnabar ſublimed, and adhering to the Neck of the Retort. ’Tis accounted a good Medicine for Epileptick and Cephalick Diſtempers.

CION *Columella*, *Gargareon*, *Gurgulio*, *Uva*, *Uvula*, *Uvigena*, *Uvigera*, *Epiglottis*, *Sublinguium*, is the Cover of the Wind-pipe, it hangs betwixt the two Glandules called *Amygdalæ*, above the Chink of the Larynx, and is a Proceſs from a Subſtance, as one would think, glandulous, ſpungy, and red; which, *Columbus* is of Opinion, ariſes from the Tunick of the Mouth redoubled in that Place. But *Riolan* ſays, it proceeds from ſome Muſcles which are terminated there. It is of a Figure roundly oblong, in the Upper-part thicker, and ending acutely. Its Uſe is to attemperate the Coldneſs of the Air, and hinder the Drink from falling upon the Noſtrils: Sometimes this *Uvula* ſticks out too far from the Humours that fall upon it, which cannot return by the Lymphatick Veſſels, whence proceeds the falling of the *Uvula*, which we call *Roof of the Mouth. Blanchard.*

The *Uvula* is moved by two Pair of Muſcles, the *Pterigoſtaphilinus Externus* and *Internus* (which ſee) and the former of theſe draws the *Uvula* backwards, and the latter plucks it forwards, becauſe of the Pulley thro’ which its Tendon paſſes, and which alters the Direction of its Motion; both which Motions are neceſſary for Deglutition, for the Articulation of the Voice, as well as to hinder any Drink, *&c.* from going into the Noſtrils.

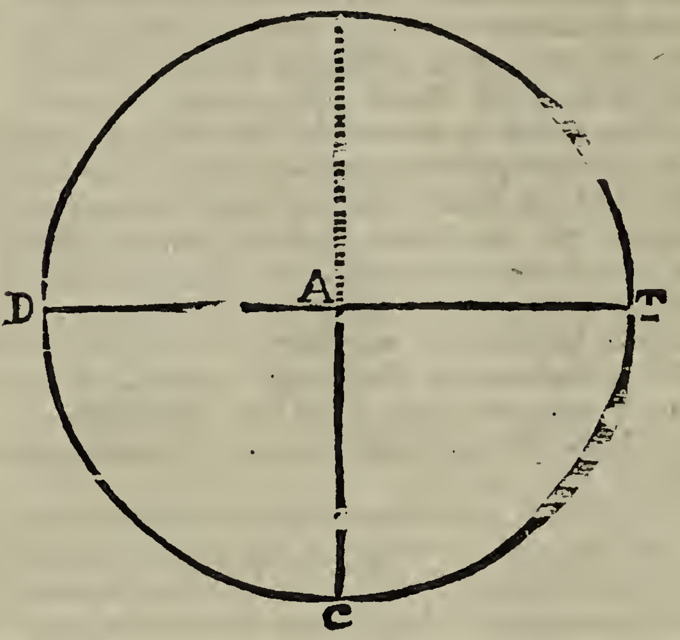
CION [in *Gardening*] a young Sprout, Sprig, or Sucker.

CIRCLE is a Plane Figure bounded with one only Line, and to which all the Right-lines that can be drawn from a Point in the Middle of it are equal to one another. And it may very well be ſuppoſed to be made thus: If you imagine the Line A B faſtened at one End to the Point at A, but yet ſo as to be moveable on A as a Center, till the End B arrive at the Place where it began. The Line A B in its Motion deſcribes a Figure, called a *Circle*, and the Point B, at the ſame time, deſcribes a *Curve-Line*, called the *Circumference of a Circle.*



From which *Geneſis* ’tis plain, that all Right-Lines drawn from the Point A (which is called the *Centre*) to the Circumference, muſt be of equal Length, or be equal to one another; and theſe Lines are called *Radius*, and by ſome *Semi-Diameter.*

The Line D T paſſing thro' the Centre, and terminated at each End by the Circumference, is called the *Diameter*, and its Half the *Semi-Diameter* or *Radius*.



Theſe Diameters are all equal to one another, and do divide the Circle into two equal Parts, which are called *Semicircles*.

Any Part of the Circumference of a Circle is called an *Ark*, which Ark is the Meaſure of any Angle, whoſe Vertex or Angular-point is at the Centre of that Circle.

Every Circle is ſuppoſed to be divided into 36 equal Parts, which Parts are called *Degrees* : Of theſe a Semicircle contains 180, and a Quarter of a Circle 90, which is called a *Quadrant*, as C T.

To find the *Superficial Content* of any *Circle*, ſee *Area* and *Polygon*, where the Ground of the Practice is demonſtrated. And ſince 'tis there proved from *Archimedes*, that a Circle is equal to a Rectangle-Triangle, one of whoſe Sides is the Radius, and the other the Periphery (or a Line equal to it). Let the Radius be called $\frac{1}{2}d$ (ſuppoſing d to be the Diameter) and whatever the unknown Ratio of the Periphery be to the Diameter, let it be expreſſed by r, then will the Periphery be $r\,d$; and conſequently the Perpendicular $r\,d$ being multiplied by Half a Radius, that is, by $\frac{1}{4}d$, the Product will be $\frac{1}{4}\,r\,d =$ *Area of the Circle* (becauſe of the Triangle).

From which way of Notation it may be preſently proved, *That Circles are to one another as the Squares of their Diameters.*

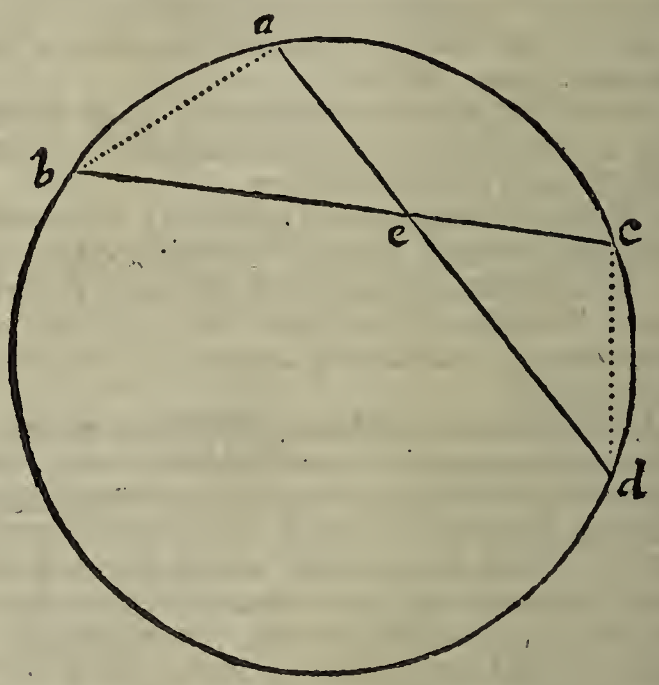
For, let the Diameter of one Circle be d, and of the other D, then their *Area's* will be $\frac{1}{4}\,r\,d\,d$ and $\frac{1}{4}\,r\,D\,D$, where $\frac{1}{4}\,r$ being a common Efficient, or Multiplicator, alters not the Ratio ; for no doubt $\frac{1}{4}\,r\,d\,d : \frac{1}{4}\,r\,D\,D :: d\,d : D\,D$. *Q. E. D.*

PROP. I.

The Parts of any two Chords cutting each other in a Circle, are reciprocally proportional.

That is, $a\,e : e\,b :: e\,c : e\,d$.

Draw $b\,a$ and $c\,d$.



Demonſtration.

1. The Triangles $a\,e\,b$ and $c\,e\,d$ are ſimilar, becauſe the Angles at e are equal, and $a = c$, becauſe in the ſame Segment ; therefore the Sides about the equal Angles are proportional ; that is, $a\,e : a\,b :: e\,c : e\,d$. *Q. E. D.*

COROL. I.

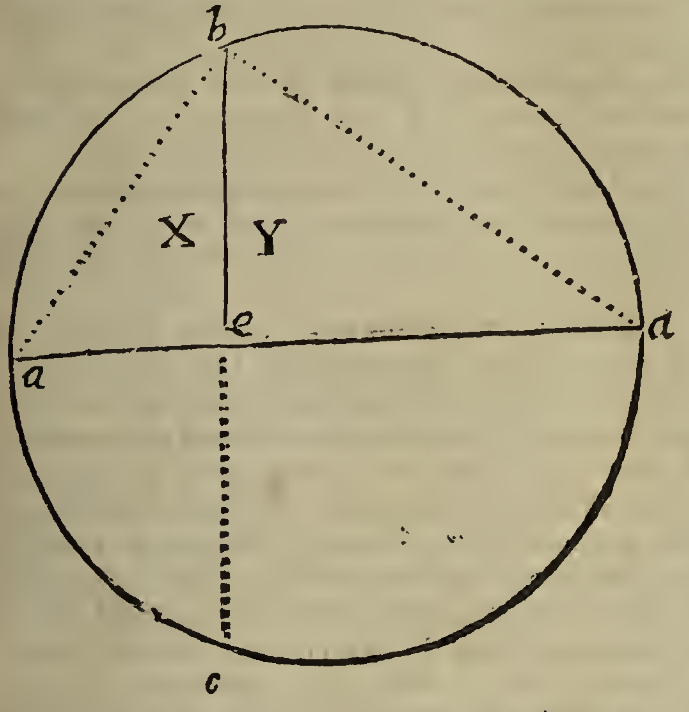
Hence, if two Chords cut each other, the Product made by the Multiplication of the Parts of one Chord, is always equal to the Product of the Parts of the other :

That is, the ▯ of the Extremes $a\,e\,d =$ ▯ of the mean Terms $b\,e\,c$.

COROL. II.

If one Chord ($a\,d$) be a Diameter, and the other ($b\,c$) cut it perpendicularly, then is $b\,e$, or its equal $e\,c$, a mean Proportional between the Parts of the Diameter $a\,e$ and $e\,d$.

For if you imagine the Lines $a\,b$ and $b\,d$ to be drawn, the Triangles x and y will be ſimilar ; and therefore $a\,e : e\,b :: e\,b : e\,d$; and then the ▯ $a\,e\,d$ $=$ □ $e\,b$.



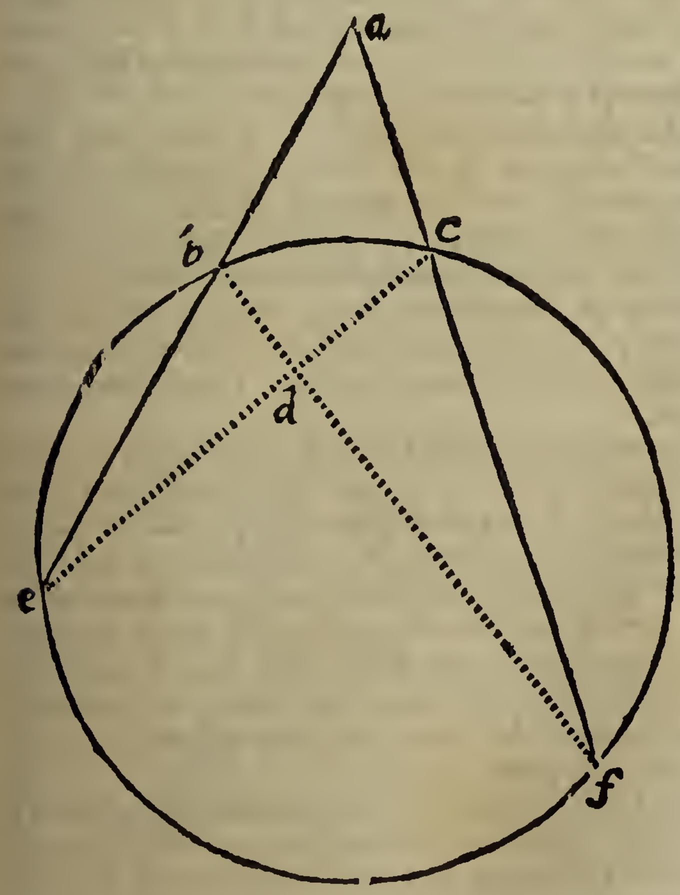
And this may be called *The general Property of the Circle ariſing from the Nature of the Curve.*

And if you call the Diameter of the Circle $2r$ (becauſe the Radius is $= r$) and conſider it as the Axis of a *Conick* Section, the Part ae in the Figure will be the Abſciſſa or intercepted Axis proper to the Ordinate be; wherefore calling, as is uſual, the Abſciſſa x, and the Ordinate y, this general Property of the Circle will be thus expreſſed, $2yx - xx = yy$; for ae being x, ad muſt be $2r - x$, and that multiplied by x gives $2rx - xx$, which muſt be equal to $\square\, ba = yy$.

PROP. II.

If two Lines (as af and ae) from a Point (a) without a Circle, be drawn to its Circumference within (as to e and f) the Rectangles made by thoſe Lines and their external Parts ſhall be equal.

That is, $\square\, eab = \square\, fac$. Or, thoſe Lines are to each other reciprocal in a Proportion of their external Parts, i. e. $ae : af :: ac : ab$.



Draw bf and ec, then are the Triangles eac and abf equiangular; for the $\angle f = \angle e$ being in the ſame Segment, and a is common.

Therefore $ae : ac :: af : ab$, and then alternately $ae : af :: ac : ab$.

Therefore $ae \times ab$ $(= eab) = fa \times ac$ $(= fac)$. *Q. E. D.*

PROBL. I.

To divide the Circumference of a Circle into any Number of Parts not above 10.

Suppoſe the Circle A B C D were to be divided.

1. The Diameter A C divides the Circle into two equal Parts.

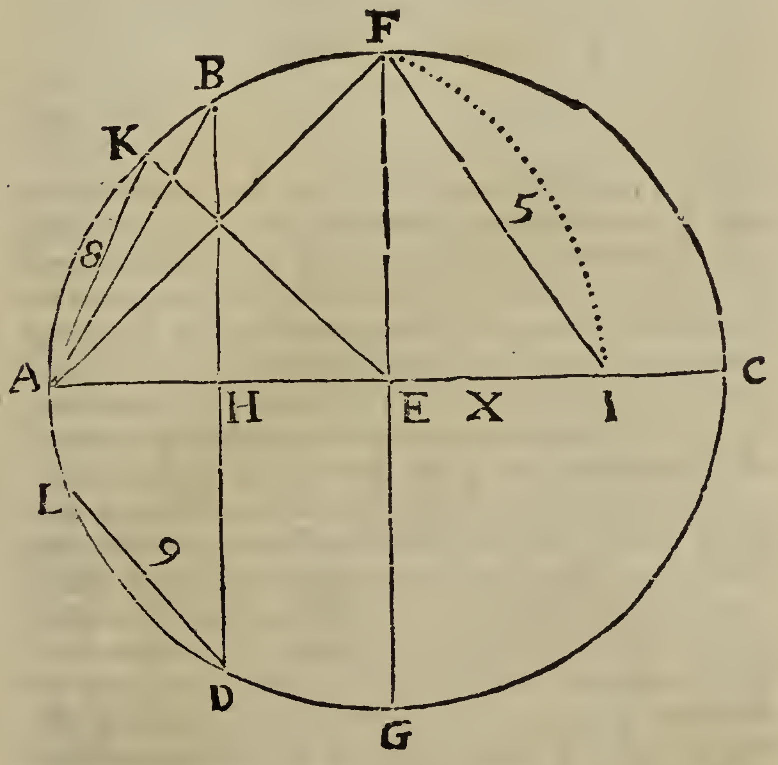
2. The Radius A E being made the Chord, A B is the Side of the *Hexagon* inſcribed by 15 *e.* 4 *Eucl.* Therefore,

3. The Line B D is the Side of an Equilateral Triangle.

4. And A F the Side of a Square inſcribed.

5. With the Diſtance H F deſcribe the Ark F I, the Right-line F I is the Side of a *Pentagon* inſcribed. 10 *e.* 13. *Eucl.*

6. The Line B H = D H is the Side of the *Heptagon.*



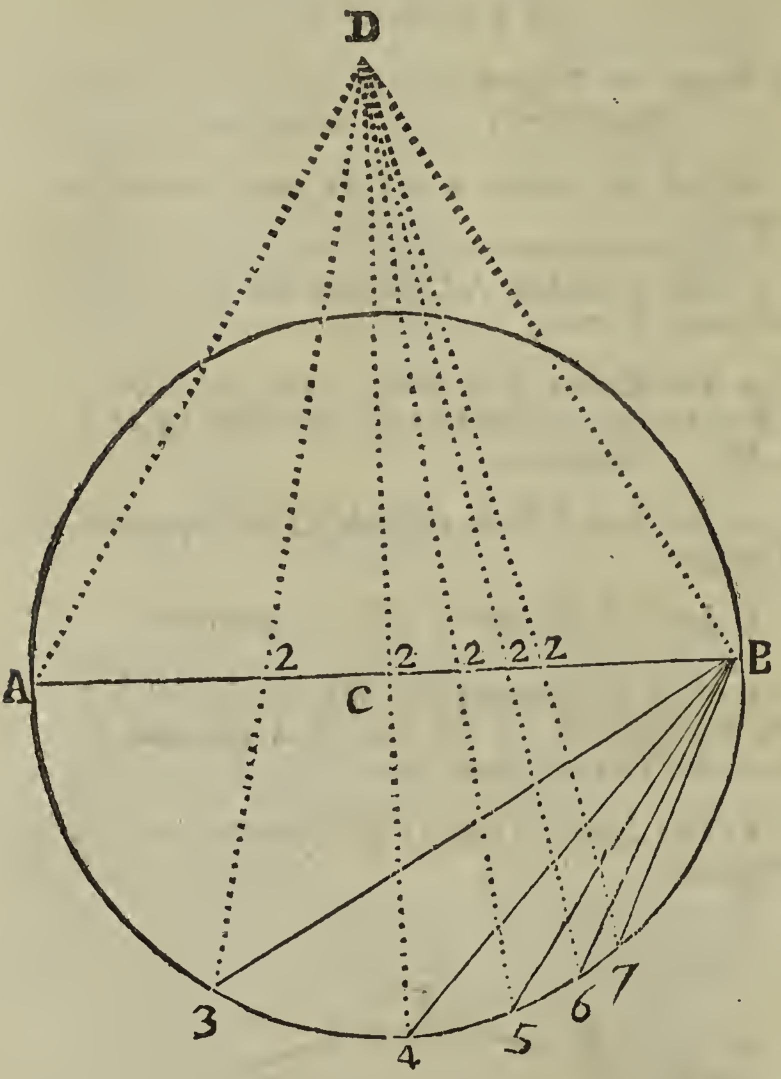
7. The Line A K (which is the Chord of Half the Ark A F) is the Side of an *Octagon* inſcribed.

8. The Line D L (which is $\frac{1}{3}$ of the Arch B A D) is the Side of a *Nonagon.*

9. The Line E I is the Side of a *Decagon.*

PROBL. II.

To divide the Circumference of a Circle into any Number of equal Parts.



Upon the Diameter A B (of the given Circle) make an equilateral Triangle A B D, and divide the Diameter A B into as many equal Parts as you deſign there ſhall be Sides of the Polygon to be inſcribed, or as the Circle is to be divided into; and omitting two, *e. g.* from B toward A, draw thro' the Beginning of the Third from D, a Right-line, to the oppoſite concave Circumference, and thence another Right-line to the End of the Diameter B.

Thus, *e. g.* To divide the Circumference into three equal Parts, divide the Diameter A B into three equal Parts, and then omitting two of them, thro' the Beginning of the third, or thro' B 2, draw the Right-line D 3; and from 3, the Line 3 B, which laſt will be the Side of the Triangle to be inſcribed; ſo 4 B will be the Side of a Square, B 5 the Side of a Pentagon, B 7 of an Heptagon, *&c.*

The Plane of any Circle may be conſidered as made up of an infinite Number of concentrical Peripheries, encreaſing from the Centre in Arithmetical Proportion; wherefore a Rank of ſuch Peripheries will be to a like Number equal to the greateſt, as 1 to 2: Wherefore the Area of a Circle is to the Surface of a Cylinder (whoſe Height is equal to the Radius, and its Baſe that of a Circle) as 1 to 2: And conſequently, if the Height of the Cylinder had been equal to the Diameter of the Circle (which is the Caſe of the Cylinder circumſcribing a Sphere) the Curve-Surface of the Cylinder would be equal to four times the Baſe of it, *i. e.* the Surface of a Sphere is quadruple to the Area of one of its great Circles; for the Surface of the Sphere is equal to the curved Surface of ſuch a Cylinder, as is proved elſewhere. See *Cylinder.*

The Proportion of the Periphery of a Circle to its Diameter is leſs than $3\frac{10}{70}$, and greater than $3\frac{10}{71}$ to 1.

The Area of any Circle to the Square of its Diameter : : is as $\frac{1}{4}$ of the Periphery to the ſaid Diameter, as is proved under *Cylinder*.

The Area of any Circle is incommenſurable to the Square of the Diameter, and ſo is alſo the Periphery to the Diameter. See *Sturmius*'s *Matheſ. Enucleat. Prop.* 43.

CIRCLE: Its Quadrature, or the Squaring of the Circle. This, according to Mr. *Leibnitz*'s 7 *Philoſoph Collect.* may be underſtood as twofold; *viz.* either by *Calculation*, or by *Lineal Conſtruction*; and each of theſe may be either perfectly exact, or elſe almoſt ſo, or pretty near. Of theſe, that which is done by accurate or exact Calculation may be called the *Analytical Way*, as that which is done by exact lineal Conſtruction, is the *Geometrical Way*; that which is done by pretty near, but not exact Calculation, may be called the *Approach*; and that by a Conſtruction only pretty near, may be called the *Mechanical Way*.

The Approaches have been further carried on by *Ceulen*, *Vieta*, and *Hugenius*; and others have given ſeveral Mechanical Ways.

The accurate Geometrical Conſtruction may be had, by which not only an entire Circle may be meaſured or ſquared, but any Section or Arch of it alſo. Indeed this is, by an exact and ordinate Motion, but it is in thoſe that they call tranſcendental Curves; which, ſaith *Leibnitz*, are erroneouſly accounted Mechanical, for they are as Geometrical as thoſe which are commonly ſo eſteemed, tho' indeed they are not all Algebraical, nor can they be reduced to Algebraick Equations of certain Degrees, becauſe they have Degrees proper to themſelves, and tho' not Algebraical, are yet Analytical.

The *Analytick Quadrature* may be again ſubdivided into three Kinds; the *Analytical Tranſcendent*, the *Algebraical*, and the *Arithmetical*.

The *Analytical Tranſcendent* is to be obtained, amongſt others, by Equations of Degrees indefinite, hitherto conſidered by; as if $Xx + X$ be $= 30$, and X be ſought, it will be found to be 3, becauſe $3 + 3 + 3 = 27 + 3 = 30$.

The *Algebraical* is done by Vulgar, tho' irrational Vulgar, or by the Roots of common Equations; which, for the general Quadrature of the Circle, or its Sectors, is indeed impoſſible.

There remains therefore the *Arithmetical* Way, which is performed by certain Series exhibiting the Quantity of the Circle exact by a Progreſſion of Terms (firſt) rational, ſuch as I ſhall here propound.

I have found (ſaith he) that if the Square of the Diameter be put 1, *i. e.* one, the Area of the Circle will be $\frac{1}{2} - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} - \frac{1}{11} + \frac{1}{13} - \frac{1}{15} + \frac{1}{17}$, *&c.* that is, diminiſhing the entire Square of the Diameter by a third Part (that it may not be too big); and then again, becauſe hereby too much is taken away, augment it one Fifth, and then diminiſh it by one Seventh, and ſo on continually in that alternate Order of the Signs, and the natural Order of the odd Numbers.

CIRCLE *Equant* [in the *Ptolemaick* Aſtronomy] is a Circle deſcribed on the Centre of the *Equant*: Its chief Uſe is to find the Variation of the firſt Inequality.

CIRCLE *of perpetual Apparition* is one of the leſſer Circles parallel to the *Equator*, being deſcribed by any Point of the Celeſtial Sphere which toucheth the Northern Point of the Horizon, and is carried about with the Diurnal Motion. All the Stars that are included within this Circle never ſet, but are always viſible above the Horizon: And the

CIRCLE *of perpetual Occultation* is another Circle at a like Diſtance from the Equator, and contains all thoſe Stars which never appear in our Hemiſphere: But the Stars ſituated between theſe Circles inceſſantly riſe and ſet at certain times.

CIRCLES *of Altitude*. See *Almicanters*.

CIRCLES *of Declination on the Globe*, ſo ſome Writers call the Meridians on which the Declination or Diſtance from the Equator of any Planet or Star is accounted.

CIRCLES *of Longitude*, on the Globe, are great Circles paſſing thro' the Star and the Pole of the Ecliptick, where they determine the Star's Longitude, reckon'd from the Beginning of *Aries*. On theſe Circles are accounted the Latitudes of the Stars.

CIRCLES *of Poſition*, are Circles paſſing by the common Interſections of the *Horizon* and *Meridian*, and thro' any Degree of the Ecliptick, or the Centre of any Star or other Point in the Heavens; and are uſed for the finding out the Situation or Poſition of any Star, *&c.*

CIRCUITY *of Action* [in *Law*] ſignifies a longer Courſe of Proceeding than is needful, to recover the thing ſued for.

CIRCULAR is any thing that is deſcribed and moved in a Round, as the Circumference of a Circle, or Surface of a Globe. The Circular Form is, of all others, the beſt diſpoſed for Motion, and the moſt capacious.

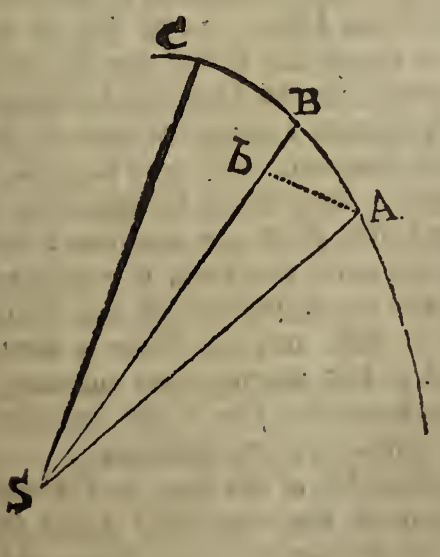
The modern Aſtronomers ſhew, that the heavenly Bodies move not in circular, but in elliptical Orbits.

CIRCULAR *Lines* [in *Mathematicks*] are ſuch ſtraight Lines as are divided from the Diviſions made in the Arch of a Circle, ſuch as *Sines*, *Tangents*, *Secants*, *&c.* an Account of the Conſtruction of which you have under the Word *Scale*.

CIRCULAR *Numbers*, or *Spherical ones*, according to ſome, are ſuch whoſe Powers terminate in the Roots themſelves.

As for Inſtance, 5 and 6, all whoſe Powers do end in 5 and 6, as the Square of 5 is 25, the Square of 6 is 36, *&c.*

CIRCULAR *Velocity* is a Term in the new Aſtronomy, ſignifying that Velocity of any Planet, or revolving Body, which is meaſured by the Arch of a Circle; as, ſuppoſe by A *b* deſcribed on the Centre of Attraction S; and the Circular Velocity of a Body moving from B to C, is meaſured by the Ark B C.



To CIRCULATE *Circulation*, [in *Chymiſtry*] ſignifies the giving a Motion to Liquors contained in a double Veſſel (that is, when the Necks of two Veſſels are excellently well luted one into another) excited by Fire, and cauſing the Vapours to aſcend and deſcend to and fro; which Operation is intended either to ſubtilize the Liquors, or elſe to open ſome hard Body that is mingled with them. The circulating Veſſel is ſometimes called a *Pelican*, or a blind *Alembick*.

CIRCULATION *of the Blood* is that Motion of it which is produced by the continual Reciprocation of the Pulſe, whereby there is a conſtant Expulſion of the Blood from the Heart into the Arteries, and as conſtant and continual an Influx of Blood into it out of the *Cava*; and ſeeing the *Vena Cava*, from whence the Supply comes, is never drawn dry; nor, on the other hand, the Arteries which receive the Blood from the Heart continually, are unduly ſwelled with it; it muſt neceſſarily follow (as our great *Harvey* firſt plainly proved) that this Motion proceeds circularly, and that the Blood is continually driven out of the Heart into the Arteries, and out of theſe into the Parts to be nouriſhed; from whence it is reſorbed by the Capillary Veins, which carry it into the larger, and theſe into the *Cava*, from whence it returns to the Heart again.

The Reaſons enforcing the Neceſſity of a *Circulation* of the Blood, are theſe:

1. The great Quantity of Blood that is driven out of the Heart into the Arteries at every Pulſe: For tho' the Ancients, who knew not this Circulation, imagined that only a Drop or two was expelled by every *Syſtole*, which they were neceſſitated to ſuppoſe, to avoid the great Diſtention that the Arteries muſt be liable to, if any conſiderable Quantity iſſued into them; yet it is certain and demonſtrable, that there muſt needs an Ounce, or more, be driven into them each time: For (taking it for granted, that there is no other Way for any Liquor to paſs from the Stomach to the Kidneys, but thro' the Heart, along with the Blood) ſeeing, if ſome Men, at ſome times, drink three Pints of Drink, they ſhall piſs it out again in Half an Hour, yea more, of *Tunbridge* Water, in that Space: And ſeeing, ſecondly, that there is commonly as much Blood as Serum that flows to the Kidneys (the Blood returning back by the emulgent Veins) it is clear, that by the two Emulgents (which are none of the largeſt Arteries) there muſt paſs in Half an Hour 6 Pounds of Liquor, all which muſt come from the Heart; and how much more then may we conceive to be driven thro' all the other Arteries that run thro' the whole Body? This is moſt accurately evinced by Dr. *Lower*'s Experiment, which is this: "I cut aſunder (ſays he) both the Cervical Arteries in a large Dog, and at the ſame time thro' an Hole made in the Left-ſide of his Breaſt over-againſt the Heart, I compreſſed the Trunk of the *Aorta* below the Heart with my Finger, to hinder any Blood from deſcending by it; and, laſtly, I took Care alſo to ſtraiten the Brachial Arteries under the Axillæ, by which means almoſt all the Blood was driven out of the Heart thro' the Cervicals (beſides that which was ſent into the Vertebrals) and, which is wonderful to be related, within the twentieth Part of an Hour the whole Maſs iſſued out; ſo that it is not to be denied, but that all paſſes thro' the Heart in that Space." And tho' it may be granted, that amidſt ſuch Wounds and Tortures the Heart does beat ſomewhat quicker than at other times; yea the

ſame thing is partly evident from Wounds in the Limbs when ſome notable Artery is cut aſunder; for 'tis ſtrange in how ſmall a time a Man will bleed to Death even at that one great Artery; yet we may give a Gueſs how much Blood is ſent out of every Pulſe, even from ordinary opening of one Vein in the Arm, from whence a notable Quantity of Blood will iſſue in a ſhort time; how much then may we ſuppoſe would flow out of all the Veins, if they were opened at one time? Seeing then 'tis evident ſo great a Quantity of Blood is expell'd out of the Heart at every Syſtole, and that for all that the Arteries are not unduly diſtended, nor any Part ſwelled by it, neither yet the Cava and other Veins emptied, 'tis certain that the Blood that is driven into the Arteries flows back to the Heart by the Veins in a conſtant Circulation.

2. A ſecond Argument to prove it may be taken from the Valves in the Veins, which are ſo framed that Blood may freely flow thro' them out of the leſſer Veins into the greater (and ſo into the Cava) but not, on the contrary, out of the greater into the leſs: Yea, if one blow into the Cava thro' a Pipe, there will no Wind paſs into the ſmaller Veins, but on the contrary, if you blow up the leſſer Veins, the Wind will readily paſs to the larger, and ſo to the Cava.

3. And laſtly, The ſame thing is moſt clear by the Ligature in Blood-letting; for whether you let Blood in the Arm or Foot, you always tie the Fillet above where you intend to make the Orifice, and then the Vein below the Ligature will preſently fill and grow tumid, but above it will fall and almoſt diſappear, which muſt needs be from hence, for that the Blood being driven along the Arteries towards the extreme Parts, returns by the Veins, and aſcends upwards, which coming to the Ligature, and being ſtopt there, ſwells the Vein below the Ligature, and ſpurts out as ſoon as the Orifice is made; but when the Fillet is looſed again, the Blood flows no longer out thereat, but holds on its wonted Channel, the Vein and the Orifice cloſes up again.

Having ſufficiently demonſtrated the Circulation of the Blood, we will ſhew two things farther: 1ſt, How the Blood paſſes out of the Arteries into the Veins: And 2dly, In what time it may be ſuppoſed to paſs thro' the Heart in its ordinary Circulation.

As to the 1ſt, It was the Opinion of *Riolanus*, that the Blood circulated only thro' the larger Veſſels, by Anaſtomoſis or Inoſculation of the Veins with the Arteries, and that that which run into the ſmaller was all ſpent on the Nutrition of the Parts. But it is clear, that there muſt be a Circulation even in the ſmalleſt, from the great Quantity of Blood that will flow out of the leaſt Artery in the Hand or Foot when it is cut; which it were very abſurd to imagine to be all ſpent on the Nouriſhment of the reſpective Parts. Now there are but two Ways whereby the Blood can be ſuppoſed to paſs out of the Arteries into the Veins, *viz.* either by the former's being continued to, or opening into the latter by Inoſculation, or elſe by the Capillary Arteries letting out their Blood into the Pores of the Subſtance of the Parts, on whoſe Nutrition Part is ſpent, and the Remainder imbibed by the gaping Mouths of the Capillary Veins. That it is neceſſary to admit of this latter Way is evident, becauſe if Part of the Arterial Blood did not iſſue into the Subſtance of the Parts, they could not be nouriſhed by it; for while it is in the Veſſels, it may add Warmth indeed to the Parts thro' which it flows, but cannot nouriſh them, ſeeing even the Veſſels themſelves are not nouriſhed by that Stream of Blood that glides along their Cavity, but by Capillaries running thro' their Coats; and if the Blood be driven into the Subſtance of the Parts, and that in a greater Quantity than ſuffices for their Nouriſhment (as was juſt now ſhewn that it is) what is ſuperfluous muſt needs enter the Mouths of the Capillary Veins, from which it goes forward to the larger, and ſo to the Heart: But ſeeing this way of transfuſing the Blood thro' the Subſtance of the Parts, has ſeem'd to ſome not to anſwer to that haſty Circulation of it as above demonſtrated, they have thought it neceſſary alſo to admit of the former Way, namely Anaſtomoſes, by which the Veins are continued to the Arteries, and that not only in their larger Branches (as that notable one of the Splenick Artery with the Splenick Vein) but alſo in their ſmaller Twigs in the extreme Parts. But we muſt conſider, that in a living Body the ſolid Parts are infinitely more porous and permeable than in a dead one; ſo that tho' the Anatomiſts find their Subſtance ſo denſe and cloſe, as to make it ſeem almoſt impoſſible they ſhould permit ſo quick a Paſſage to the Blood thro' them, yet they ſhould rather believe it, than ſuppoſe ſuch Anaſtomoſes as they cannot diſcover (tho' it were not difficult to find them out if they had an Exiſtence); for abateing the ſingle one of the Splenick Artery with the *Ramus Splenicus* of the *Porta* (and perhaps ſome of the *Arteriæ* with the *Vena Pulmonaris* in the Lungs) none of the lateſt moſt accurate Anatomiſts have been able to find out any: And as for that mentioned, it ſeems rather to have an Artery with an Artery (ſuch as are frequent in ſeveral Parts of the Body, as are alſo of one Vein with another) than of an Artery with a Vein; for the *Porta* from which this *Ramus* is propagated, is generally reputed rather an Artery than a Vein.

And 2dly, As to the Space of time in which the whole Maſs of Blood may ordinarily circulate thro' the Heart, it is probably much ſhorter than many have imagined: For ſuppoſing that the Heart makes 2000 Pulſes an Hour (which is the leaſt Number any ſpoke of, and ſome have told twice as many) and that at every Pulſe there is expelled an Ounce of Blood (which we may well ſuppoſe, ſeeing the Ventricles are wide enough to contain two Ounces, and that it is probable alſo, both that they are filled near full in the *Diaſtole*, and that they are near, if not quite emptied by the ſtrong Conſtriction of the Heart in the *Syſtole*) ſeeing the whole Maſs uſually exceeds not 24 Pounds, it will be circulated ſix or ſeven times over, thro' the Heart, in the Space of an Hour: And by ſo much the oftner by how much the Blood comes ſhort of the ſuppoſed Quantity, or the Pulſe, either naturally, or by a Fever, ſpirituous Liquors or violent Motion is rendered more frequent. By which quick Motion, the Blood itſelf is kept from Coagulation and Putrefaction, and the Parts are cheriſhed with vital Heat, which Heat of the Parts is much according to the Slowneſs or Rapidneſs of the Circulation: So when we ſit ſtill, and the Pulſe is ſlow or rare, we grow cold; but when, upon running, or any other violent Exerciſe, the Pulſe becomes more frequent and quick, we become hot.

CIRCULATION *of the Sap* [in *Vegetables*] is a natural Motion of the nutritious Juice of Plants, from the Root to the extreme Parts, and thence back again to the Root.

That there is ſuch a Circulation in the Bodies of Vegetables, ſeems to be evinced by the Experiments of modern Naturaliſts and Gardeners, by means of certain Veſſels analogous in them, analogous to the Veins and Arteries in Animals.

The Notion of the Circulation of the Sap was firſt ſtarted by Mr. *Perrault* in *France*, who propoſed it to the Royal Academy in the Year 1667, tho' it had been publiſh'd unknown to Mr. *Perrault* two Years before, by Mr. *Mayor* a Phyſician at *Hamburgh.* About the Year 1669, Mr. *Marriotte*, not knowing that Mr. *Perrault* had propoſed the ſame before, propoſed it again to the Academy as a new Diſcovery of his own; and it appears that about the ſame time *Malpighius* had been about the ſame Diſcovery.

As to the Manner of the Circulation, it is eaſy to be conceived. *Malpighius*, Dr. *Grew*, and others ſince, have diſcovered, by the Help of Teleſcopes, that the Wood of Plants conſiſts of fine Capillary Tubes which run parallel from the Root thro' the Trunk, which perform the Office of Arteries, and that there are other large Tubes on the Out-ſide between the Wood and the inner Bark, that do the Office of Veins.

And hence the Root having imbibed a Stock of Juice from the Earth, that Juice is put in Motion by Heat. *i. e.* it will be rarefied and made to aſcend in the Form of a Stream or Vapour, and arriving at the open Mouths of the Arterial Veſſels, it will aſcend thro' them to the Top and extreme Parts of the Tree, with a Force proportionable to the Degree of the Heat by which it was put in Motion; and when it has arrived at the extreme Parts, it will be condenſed into a Liquor, by meeting with the Cold of the external Air; and from thence, in that Form, returns towards the Root of the Venal Veſſels before mentioned, by its own Weight.

Many Experiments have been produced to prove this Circulation in Plants, by way of Ligature and Inciſion, as is done in Animals, eſpecially in thoſe Plants which abound moſt in Sap, as the Milk-Thiſtle, *&c.* and that with the ſame Succeſs, the Part between the Ligature and the Root ſwelling very conſiderably, and others becoming much leſs.

We have an Inſtance from Dr. *Leſter*, in the *Cataputia Minor*, who made uſe of a Silken Thread for a Ligature (tho' the uſual Way is by Rings of Metal) and tied the Plant as hard as could be done without breaking the Skin, but found no greater Swelling on one Side than on the other of the Ligature.

But Mr. *Lawrence* has preſented the World with an Experiment to demonſtrate the Circulation of the Sap, try'd on the *Yellow-ſtrip'd Jeſſamin.*

If you take a Bud of the *Yellow-ſtrip'd Jeſſamin*, and inoculate it upon a Branch of *Plain Jeſſamin*, whoſe Stem ſpreads itſelf in two or three Branches in Autumn, the following Summer, as the Tree comes to ſhoot, ſome of the Leaves will be here and there ting'd with Yellow, and this even upon the Branches not inoculated, 'till by Degrees the whole Tree, even the very Wood of the young Branches will be all variegated or ſtrip'd with Green and Yellow.

This Experiment has alſo been confirmed by one of the like Nature by Mr. *Fairchild*, who inoculated a *Yellow-ſpotted Jeſſamin* Tree into another *Jeſſamin* Tree; and, he ſays, he found, that tho' the Bough did not take, yet in a Fortnight's time Yellow Spots began to appear on a Shoot which came out of the Ground from another Part of the Plant.

However, this Opinion of the Circulation of the Sap is not univerſally received, ſome able Botaniſts ſtrenuouſly oppoſing it.

Mr. *Dodart* indeed does allow, that the Juice of Plants does aſcend from the Root to the Extremities of the Branches, and of another that does deſcend from the Extremities of the Branches to the Root, that the firſt is imbib'd from the Soil, and is digeſted in the Root for the Nouriſhment of the Plant, the ſecond received from the moiſt Parts of the Air in at the Extremities of the Branches; therefore, according to his Opinion, the riſing Juices are not the ſame with the deſcending Juices, or that that Juice which riſes does never deſcend, *i. e.* that there is no Circulation.

Dr. *Tong* is much of the ſame Opinion, and maintains (in the *Philoſophical Tranſactions*, that the Sap always riſes, but never properly deſcends, that it has only a Subſiding or Recidivation, which he cannot allow to be a *Circulation.*

Mr. *Switzer* acknowleeges himſelf to be at a Loſs as to the Method whereby the *Circulation* ſhould be effected, as well as for the Parity of Reaſon commonly urged for a *Circulation* of the Sap, and of the Blood in Animals.

He obſerves, That the Degree of Growth or Extenſion in Animals is but ſmall, ſo that the Blood may eaſily be ſuppoſed to circulate in them, it not being employed in any other Service; but, inaſmuch as Trees grows to an unlimited Talneſs, he thinks it more probable that the great Effort of Nature is imployed in extending them that way, and that the nutritious Juice does only aſcend.

He likewiſe adds, that the Swelling or Extenſion of Trees in Bulk evidently proceeds from the Effuſion of the Sap from the Heart of the Tree thro' the Pores, which dilates the whole inſenſibly, by accumulating Circle on Circle, which are annually Gradations eaſily perceived upon cutting a Branch or Trunk acroſs.

The Reverend Mr. *Hales*, in his 4th Chapter of his excellent Treatiſe called *Vegetable Staticks*, ſays, He thinks he has, by the Experiments he there gives, and Obſervations, ſufficient Ground to believe that there is no *Circulation of the Sap* in Vegetables, notwithſtanding that many ingenious Perſons have been induced to think there was, from ſeveral curious Obſervations and Experiments, which evidently prove that the Sap does in ſome meaſure recede from the Top towards the lower Parts of Plants, whence they were, with good Probability of Reaſon, induced to think that the Sap did circulate.

CIRCULATORIUM is a Glaſs-Veſſel, wherein the Liquor infuſed by its aſcending and deſcending, rolls about as it were in a Circle. There are ſeveral Sorts of theſe Veſſels, but two eſpecially of Moment and Uſe, that called *Pelicanus*, and the other *Diota*, which ſee, as alſo *Double Veſſel.* L.

CIRCULUS is a round Inſtrument made of Iron, uſed by Chymiſts for the cutting off the Necks of Glaſs-Veſſels, which is performed thus: The Inſtrument being heated, is applied to the Glaſs-Veſſel, and is there continued 'till it grow hot; then, with ſome Drops of cold Water, or a cold Blaſt upon it, it flies in Pieces.

This Way they cut off the Necks of Retorts or Cucurbits.

CIRCUMAGENTES *Muſculi*, are certain oblique Muſcles of the Eyes, ſo called from their helping to wind and turn the Eyes round about.

CIRCUMAMBIENT. See *Ambient.*

CIRCUMFERENCE is the outermoſt bounding Line of any Plane Figure, but it more properly belongs to the Perimeter of a Circle, as is apparent from the Geneſis of a Circle.

All Lines drawn from the Centre of a Circle to the Circumference, are equal, and are called *Radii.*

Any Part of a Circumference is called an *Arch*, and a Right-line drawn from the one Extreme of the Arch to the other, is called a *Chord.*

The Circumference of every Circle is ſuppoſed to be divided into 360 Degrees.

The Angle at the Circumference of a Circle is double that at the Centre.

Every Circle is to a Triangle, whoſe Baſe is equal to the Circumference, and its Height to the Radius; hence the Circumferences of Circles are to each other as their Radii.

Hence again the Circumference of one Circle is to its Radius as that of any other Circle to its Radius.

The Ratio of the Circumference to the Radius is the ſame in all Circles.

Archimedes makes the Ratio of the Diameter of a Circle to its Circumference as 7 to 22; others bring it nearer the Truth, as 10000000000000000 to 31415926535897932.

Vieta, *Huygens*, *&c.* commend the Proportion of 100 to 314 in ſmaller Circles, and of 1000 to 3145 in larger.

But *Metius* gives the juſteſt Proportion in ſmall Numbers, which is as 113 to 355.

Therefore the *Diameter* of a Circle being given, its *Circumference* is had; and that multiplied by one Fourth of the Diameter, gives the Area of the Circle. See *Circle.*

CIRCUMFERENTER, an Inſtrument uſed in Surveying, being the ſame with the *Theodolite*, which ſee.

CIRCUMFLEX *Accent* [in *Grammar*] is compoſed both of the *Acute* and the *Grave*, and it is expreſſed thus (^).

CIRCUMGYRATION is the wheeling Motion of any Body round a Centre.

CIRCUMJOVIALISTS [in *Aſtronomy*] *Jupiter*'s Satellites, contain Stars that attend on the Planet *Jupiter*.

CIRCUM-POLAR *Stars* are ſuch Stars as, being pretty near our *North Pole*, do move round it, and in our Latitude never ſet or go below the *Horizon*.

A TABLE *of* Circumpolar Stars.

Magnitude.	NAMES.	Right-Aſcenſion in Time under the Pole-Star.			Difference in Time between the Pole-Star and the Pole.			*Azimuth* under the Pole-Star.			Coaſting.
		H.	*M.*	*S.*	*H.*	*M.*	*S.*	*D.*	*M.*	*S.*	
2	Upper Follower in □	0	3	53	0	4	26	0	37	12	E
3	Penult. in Dragon's Tail	0	20	17	0	3	19	0	19	12	E
2	Cor Caroli	0	36	40	0	0	5	0	0	54	E
2	Aliot	0	39	25	0	0	14	0	2	2	*W*
2	Middle Great Bear's Tail	1	7	2	0	3	44	0	33	0	*W*
2	Tip of his Tail	1	28	56	0	5	49	0	57	0	*W*
2	*Antepenult.* in Dragon's Tail	1	47	40	0	10	58	1	16	48	*W*
2	Upper Guard of the Little Bear	2	26	5	0	24	10	1	55	48	*W*
3	Lower Guard	2	57	15	0	26	50	2	24	36	*W*
3	Draco, 27. in *Tycho*'s Catalogue	2	59	49	0	18	0	2	27	0	*W*
3	———26.	3	35	17	0	21	4	2	55	48	*W*
3	———25.	3	54	54	0	24	39	3	10	12	*W*
3	———24.	4	36	43	0	30	49	3	34	48	*W*
3	———20.	3	58	34	0	30	43	3	12	36	*W*
3	Firſt in his Head	4	59	30	0	23	40	3	45	0	*W*
2	Bright one in the Head	5	25	1	0	24	11	3	53	24	*W*
1	Lucida Lydra	6	5	34	0	20	30	4	0	36	*W*
3	North in *Draco*'s Upper-Turn	6	37	4	0	35	44	4	1	12	*W*
3	South in its Upper-Turn	7	11	21	0	37	56	3	56	24	*W*
3	Swan's Upper-Wing	7	13	26	0	21	49	3	56	24	*W*
3	Star in her Breaſt	7	51	26	0	19	20	3	45	0	*W*
2	——in her Tail	8	10	30	0	19	59	3	37	12	*W*
2	*Cepheus*'s Right-Shoulder	8	45	35	0	25	2	3	18	36	*W*
3	————Girdle	8	53	30	0	30	44	3	13	48	*W*
3	————Knee	11	10	0	0	17	59	1	25	48	*W*
3	*Caſſopeia*'s Chair	11	46	7	0	5	54	0	51	0	*W*
3	————Breaſt	12	20	48	0	1	50	0	16	48	*W*
3	Star in the Hip	12	37	50	0	0	2	0	0	10	*W*
3	——in her Knee	13	8	45	0	3	41	0	31	12	E
3	——in her Leg	13	39	38	0	7	53	1	1	12	E
2	Foot of *Andromeda*	13	50	37	0	6	19	1	12	0	E
3	*Meduſa*'s Head	14	59	14	0	11	45	2	13	48	E
2	Bright Star in his Side	15	14	59	0	14	20	2	26	24	E
2	*Capella* in *Auriga*	17	13	55	0	20	49	3	40	48	E
2	——— in his Right-Shoulder	17	58	7	0	21	55	3	55	12	E
3	North in the Great Bear's Right-Foot	20	50	49	0	20	52	3	28	12	E
3	South in the ſame Foot	20	55	23	0	20	13	3	21	0	E
3	—— in the Left-Knee	21	24	15	0	19	57	3	7	12	E
2	Lower Leader in the □	22	54	50	0	12	57	1	50	24	E
2	Upper Leader	22	57	59	0	14	20	1	47	24	E
3	Laſt in *Draco*'s Tail	23	24	13	0	13	36	1	20	24	E
2	Great Bear's Left-Thigh.	23	43	36	0	6	38	0	59	24	E

N. B. □ *ſtands for Four Stars in* Charles's-Wain.

The Uſe of the foregoing Table.

1. *For the Hour of the Night.*

In a North-Window, or any convenient Place, hang up a fine String with a weighty Plummet, and placing your Eye at ſome Diſtance (backward) mark when any Star in the Table comes to your String, ſo that it cut both it and the Pole-Star together; then, from that Star's Right-Aſcenſion (in the Table) take the Right-Aſcenſion of the Sun, adding 24 Hours to the Stars (if need be) the Remainder is the exact Time of the Night.

N. B. *The Stars mark'd with* (*W*) *in the laſt Column, come under the Pole after they have been in the Vertical of the Pole-Star, when they are Weſt of the Pole.*

2. *To find a true Meridian.*

Place a ſecond Line and Plummet behind the former (which was for the Hour) and having, by the former, obſerved when any Star in the Table comes to a Perpendicular with the Pole-Star, then count, by a Pendulum-Clock or Watch, the Difference in Time expreſſed in the ſecond Column, and belonging to the Star you obſerve; then at the Moment when the Account is up, bring the two Strings and the Star all in a Right-line, and then your two Strings are in the *Meridian.*

The two laſt Columns ſerve for the ſame Uſe: For when any of theſe Stars are under the Pole-Star, making the two Strings cut both the Polar-Star and the other, theſe two Strings hang ſo far out of the *Meridian Line*, as is the *Azimuth* expreſſed in the Table, which *Azimuth* is ſhewn to be Eaſt or Weſt, as in the laſt Column.

N. B. *There are three Stars in the Table, which being under the Pole-Star, are inſenſibly near the* Meridian, *viz.* Caſſiopeia*'s* Hip, Cor Caroli, *and* Alioth; *ſo that when they are under the Pole-Star, a* Meridian *may be found (very near) by one Thread.*

Obſerve alſo, *That there is juſt 4 Hours wanting only one Second between the coming of* Cor Caroli *and the 24th Star of* Draco *(in* Tycho*'s Catalogue) under the Pole-Star.*

CIRCUMSCRIBED [in *Geometry*] a Figure is ſaid to be circumſcribed, when either the Angles, Sides, or Planes, of the outward Figure, touch all the Angles of the Figure that is inſcribed.

CIRCUMSCRIBING [in *Geometry*] denotes the deſcribing a Polygonous Figure about a Circle, in ſuch a Manner that all its Sides ſhall be Tangents to the Circumference.

Sometimes the Term is uſed for the deſcribing a Circle about a Polygon, ſo as that each Side is a Chord; but in this Caſe it is more uſual to ſay, *the Polygon is inſcribed,* than *the Circle is circumſcribed.*

CIRCUMSCRIBED *Hyperbola* is one that cuts its own *Aſymptotes*, and contains the Parts cut off within its own proper Space. See *Curves.*

CIRCUMSCRIPTION [in *Natural Philoſophy*] is the Termination or certain Bounds or Limits of any Natural Body: They make it either *Internal*, which belongs to the Eſſence and Quantity of every Body, whereby it hath a certain determinate Extenſion, Bounds, and Figure; or *External*, which they call alſo *Local*, becauſe it is referred to the Place within which any Body is confin'd; for a Body is ſaid to be *Circumſcribed Locally*, or to be in a Place *Circumſcriptively*, when it hath a certain and determinate *Ubi*, or Place, in reſpect of the *Circum-ambient* Bodies. *L.*

CIRCUMSTANCES are ſuch Things, which, tho' they are not eſſential to any Action, do yet ſome way affect it: And they reckon that ſome Circumſtances are purely Phyſical, which do not connect any moral Good or Evil with an Action; ſuch as killing a Man with a Right or Left-hand, *&c.* and others they account properly Moral, becauſe they do really influence our Actions, and render them more Good or Evil than they would be without ſuch Circumſtances. And the Writers of *Ethicks* ſum them all up in this one Verſe:

> *Quis, quid, ubi, quibus auxiliis, cur, quomodo, quando.* Vid. *Whitbey's* Ethicks, p. 13.

CIRCUMSTANTIBUS [in *Law*] is a Term uſed for the ſupplying and making up the Number of Jurors (in caſe any impannelled appear not; or appearing, are challenged by either Party) by adding to them ſo many of the Perſons preſent as will make up the Number.

CIRCUMVALLATION, or *the Line of Circumvallation* [in *Fortification*] is a Trench bordered with a Parapet, dug round about the Beſiegers Camp, within Cannon-ſhot of the Place, to hinder the Relief of the Beſieged, and to ſtop Deſerters: It is uſually flank'd at the Diſtance of a Musket-ſhot with Redoubts, and other ſmall Works, or with Field Forts raiſed upon the moſt eminent Poſts. Care muſt be taken never to draw a *Line of Circumvallation* at the Bottom of a Riſing-Ground, leſt the Enemy having ſeized on the Station, ſhould plant Cannon there, and by that means command the Line. This Line is uſually about ſeven Foot deep, and twelve broad.

CIRCUMVOLUTIONS [in *Architecture*] the Turns of the Spiral Line of the *Ionick* Volute.

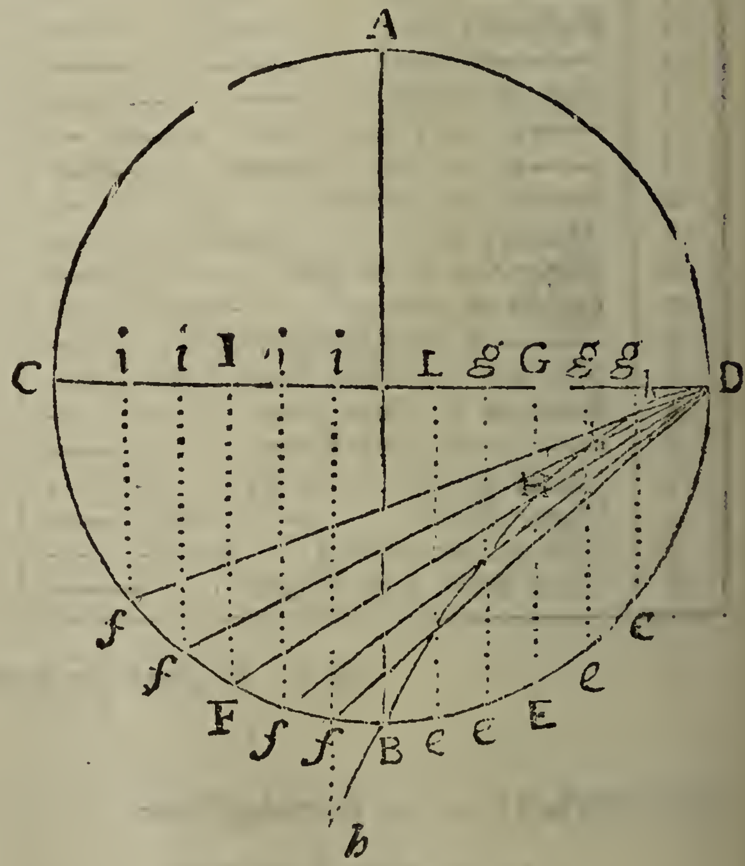
CIRRI [in *Botany*] are thoſe fine Strings or Hairs by which ſome Plants faſten themſelves, in order to their Support in their creeping, as Ivy, *&c.*

CIRSOCELE [Κιρσοκήλη of Κίρσος, *a Dilatation*, and Κήλη, *a Rupture*, *Gr.*] is a Swelling of the preparing Veſſels about the Teſticles, ſo that they ſometimes look like a third Teſticle. *Blanchard.*

CIRCOS [of Κίρσος, *Gr.*] or *Varix*, is a Dilatation and Swelling of the Veins, crooking or winding, and ariſing in one or more Parts of the Body, inſomuch as the Veins threaten a Rupture. *Blanchard.*

CISSOID, the Name of a Curve-line invented by *Diocles*, and thus produced or generated.

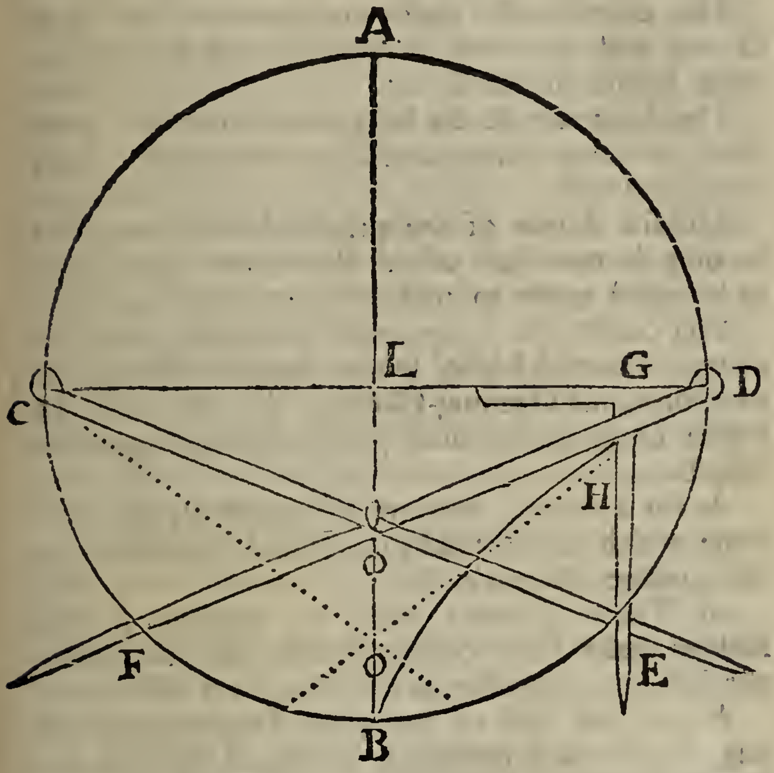
Let there be two Diameters of a Circle, A B and C D, cutting one another at Right-angles.



From B take equal Arks, as B *e* and B *f*, or B E and B F; and then from *e* or E, *&c.* erect the Perpendiculars *e g* or E *g*, then draw the Tranſverſe Lines D *f* and D F, *&c.* cutting thoſe Perpendiculars in H and *h*, *&c.* by which means you may find as many Points as you pleaſe in thoſe Perpendiculars, through which to draw the Curve D *h* A *h* B *h* (which may be continued below the

Circle if you pleaſe). And this is called the *Ciſſoid.*

A Way to deſcribe which Curve Organically the ſecond Figure repreſents.



Where two Rulers being faſtened at C and D, and moveable upon thoſe Points, interſect one another, as at O, or in B; and then a Square, as L G E, being ſo placed, that G E and L B are coincident; as alſo the three Points, O, B, and E, if the two Rulers be moved upwards; ſo then the interſecting Point O begins to aſcend, and the Square at the ſame time moves upwards alſo, with its Upper-Leg L G always parallel to C D, the Interſection of the Point H, or Angle of the Square with the Rule F D, ſhall, in its Aſcent, deſcribe the Curve B H D, which is the true *Ciſſoid.*

Propoſition.

If from any Point of the Diameter C D (See Fig. 1. above) as from G, you draw a Perpendicular, as G E, thro' the *Ciſſoid,* the Lines C G, G E, G D, and G H, will be continually proportionable.

Demonſtration.

The Lines G E and I F being Right Sines, and and alſo G D and I C being verſed Sines of equal Arks, will be equal; wherefore, becauſe of the Circle, D I : I F (*i. e.* C G : G E) : : I F : I C; *i. e.* G E : G D. But by Similar Triangles, D G : G H; : D I : I F (that is, as C G : G E); ſo is C G, G E : : G E, G D : : G D, G H; that is, thoſe Lines are all in continual Proportion. *Q.E.D.*

How, by the Help of his Curve, to find two mean Proportionals. See *Sturm. Math. Enucleat. Prop.* 21. *of Book* 2. *and Conſ.* 1.

CITADEL is a Fort of four, five, or ſix Baſtions, built ſomewhere near a City, that it may command it in caſe of a Rebellion; ſo that the City is not fortify'd on that Part againſt the Citadel, tho' the Citadel is againſt the City. The moſt uſual Form for Citadels is that of a *Pentagon,* a *Square* being too weak, and an *Hexagon* too big.

CITATION [in *Law*] an Aſſignation or Summoning of a Perſon before an Eccleſiaſtical Judge, on ſome Affair relating to the Church.

CITTA, or *Pica,* is a depraved Appetite, when People long for thoſe things which are not fit to be, nor ever are eat, as Lime, Coals, Shells, Cloth, Hides, Sand, *&c.* *Blanchard.*

CIVIL-DAY. See *Day.*

CIVIL-LAW is properly the peculiar Law of each State, Country, or City. But what we uſually mean by the Civil-Law, is a Body of Laws compoſed out of the beſt of the *Roman* and *Grecian* Laws, and which was in the main received and obſerved throughout all the *Roman* Dominions, for above Twelve hundred Years. The *Romans* took the firſt Grounds of this Law from the Twelve Tables, which were Abridgments of the Laws of *Solon* at *Athens,* and of other Cities in *Greece,* famous for Knowledge and Wiſdom, to which they added their own ancient Cuſtoms of the City of *Rome.* Theſe written Laws were ſubject to various Interpretations, whence Controverſies ariſing, they were determined by the Judgment of the Learned; and theſe Determinations were what they firſt called *Jus Civile,* after their ſeveral *Caſes* were compoſed, which, leſt the People ſhould make them at Pleaſure, were fixed certain and ſolemn; and this Part of their Law they called *Actiones Juris,* Caſes at Law. And, by the by, the *Romans* had alſo their *Plebiſcita,* which were Laws made by the Commons without the Authority of the Senate. The *Jus Honorarium,* which was an Edict of ſome particular Magiſtrate; the *Senatus Conſultum,* which was an Ordinance made by the ſole Authority of the Senate; and the *Principalis Conſtitutio,* which was Enacted by the Prince or Emperor: Theſe Laws grew, by Degrees, to a vaſt Number of Volumes; and therefore the Emperor *Juſtinian* commanded his Chancellor *Tribonian,* with the Aſſiſtance of the other eminent Lawyers of that Time, to reduce it to a perfect Body. *Suidas,* and ſome others, reflect on *Tribonian*'s Learning and Integrity in this great Work; but no one can excuſe his Haſte and want of Care; for he did that in three Years time, which the Emperor ſaith (in the Conſtitutions) he could not have imagined would be effected in leſs than Ten: For this Law had now been in Practice above 1000 Years, and the Volumes of it were ſwelled to the prodigious Number of 2000, which 'twas impoſſible for *Tribonian* to read over in that time, much leſs to compare and digeſt them well. However, this Body of Law is called the *Digeſts,* or *Pandects.*

This Body of the *Civil Law* is divided into three Volumes, which are ſtill remaining; *viz.* the *Pandects* or *Digeſts,* the *Code,* and the *Inſtitutes,* which ſee. Afterwards, to theſe were added, the *Authenticks,* or *Conſtitutions* of *Juſtinian,* called alſo *Novellæ,* which ſee, alſo under the Word *Authenticks.*

The *Civil-Law* is not received, at this Day, in any one Nation, without ſome Addition or Alteration; for ſometimes the *Feudal-Law* is mixed with it, or *general* or *particular Cuſtoms*; and often Ordinances and Statutes cut off a great Part of it.

In *Turkey,* the *Juſtinian Greek Code* is only uſed. In *Italy,* the *Canon-Law* and *Cuſtoms* have excluded a good Part of it. In *Venice, Cuſtom* hath almoſt an abſolute Government. In the *Milaneſe,* the *Feudal-Law* and *particular Cuſtoms* bear Sway. In *Naples* and *Sicily,* the *Conſtitutions* and *Laws* of the *Lombards* are ſaid to prevail. In *Germany* and *Holland,* the *Civil-Law* is eſteemed to be the *Municipal-Law*; but yet many Parts of it are there grown obſolete, and others are altered, either by the *Canon-Law* or a *different Uſage.* In *Friezland* it is obſerved with more ſtrictneſs. But in the *Northern Parts* of *Germany,* the *Jus Saxonicum, Lubicenſe,* or *Culmenſe*, is preferred before it. In *Denmark* and *Sweden* it hath ſcarce any Authority at all. In *France* only a Part of it is received, and that Part is, in ſome Places as a *Cuſtomary Law*; and in thoſe Provinces neareſt to *Italy*, the *Municipal written Law*. In Criminal Cauſes, the *Civil-Law* is more regarded in *France*, but the Manner of Trial is regulated by Ordinances and Edicts. The *Civil Law*, in *Spain* and *Portugal*, is corrected by the *Jus Regium* and *Cuſtom*. In *Scotland*, the Statutes of the *Sederunt*, Part of the *Regiæ Majeſtatis*, and their *Cuſtoms*, control the *Civil-Law*.

CIVIL-YEAR is the Legal Year, or Annual Account of Time, which every Government appoints to be uſed within its own Dominions; and 'tis ſo called in Contradiſtinction to the *Natural Year*, which is meaſured exactly by the Revolution of the Heavenly Bodies.

CIVILISATION, a Law, Act of Juſtice, or a Judgment, which renders Criminal Proceſſes Civil, which is performed by turning an Information into an Inqueſt, or the contrary.

CLAIR OBSCURE, CHIARO OBSCURO, [in *Painting*] is the Art of diſtributing the Lights and Shadows of a Piece to Advantage, both with reſpect to the eaſing of the Eye, and the Effect of the whole Piece.

Thus when a Painter gives his Figures a ſtrong *Relievo*, looſens them from the Ground, and ſets them free from each other, by the artful Management of the Lights and Shadows, it is common to ſay, He underſtands the *Clair Obſcure*.

The *Clair Obſcure* makes one of the greateſt Diviſions or Branches of Painting, the whole of a Picture being reſolvable into Light and Shadow.

The Words *Clair Obſcure* is a Compound of two others. The *French* uſe *Clair* for thoſe Parts of a Painting which reflect the moſt Light, and comprehends not only the Lights themſelves, but alſo thoſe Colours that are luminous. By *Obſcure* is meant, not only all the Shades, but alſo all the Colours that are dusky.

The Doctrine of the *Clair Obſcure* may be brought under the following Rules.

1ſt, As to *Light*, that may be conſidered with reſpect; 1ſt, to itſelf; 2d, to its Effects; 3d, the Place where it is diffuſed; and 4thly, its Uſe.

1. The *Light* is either *Natural* or *Artificial*.

Natural Light proceeds immediately from the Sun, which its Bulk and its Colour various according to the Time of the Day; or it is that of a clear Air through which the Light is ſpread, and the Colour of which is a little blewiſh; or a cloudy Air, which is darker, yet repreſents Objects with more Eaſe to the Eye, and that in their genuine Colours.

Artificial Light proceeds from Fire or Flame, and tinges the Object with the Colour of itſelf; but the Light it projects is very narrow and confined.

For the 2d. *The Effects of Light*, they are either *Principal* or *Secondary*.

The *Principal* is when all the Rays fall perpendicularly on the Top of a Body, without any Interruption; or *glancing*, as when it ſlides along Bodies.

The *Secondary*, which is for things at a Diſtance.

3. For the *Place*, That is either the *Open Campaign*, which cauſes Objects to appear with much Softneſs; or it is an *Incloſed Place*, where the Brightneſs of it is more vivid, the Diminution more haſty, and the Extremes more abrupt.

4. For the *Uſe*. The *Light of the Sun* is always to be ſuppoſed to be without, and overagainſt the Picture, that by its Means the foremoſt Figures may be heightened, the Luminaries themſelves never appearing, becauſe that the beſt Colours cannot expreſs them.

The chief Light ought to meet on the chief Group, and as much as poſſibly can be, on the chief Figure in the Piece.

The Light ought to be purſued over the great Parts, without being croſſed or interrupted with little Shadows.

The full Force of the principal Light ought to be only in one Part of the Piece, and Care ought to be taken never to make two contrary Lights.

You ought not ſcrupulouſly to confine your ſelf to one univerſal Light, but to ſuppoſe other acceſſory ones, as Opening-Clouds, *&c.* in order to looſen ſome things, and produce other agreeable Effects.

As for *Shadows*, they are diſtinguiſhed, 1ſt, Into thoſe which are formed into Bodies themſelves, by their proper *Relievo's*.

2d. Thoſe Shadows made by adjacent Bodies, ſuch as make Parts of any Whole, and the different Effects, according as the Places are different.

As for the firſt of theſe, the Degrees of theſe ought to be well managed, in regard that the different Effects of Light appear only by Shadows.

The Place which admits of no Light, and where the Colours are loſt, muſt be darker than any Part that has *Relievo*, and diſpoſed in the Front.

The Reflex, or Return of Light, brings with it a Colour that it borrowed from the Subject that reflects it, and flies off at an Angle, greater or leſs, according to the Situation of the reflecting Body, with reſpect to the luminous one; and hence the Effects of it muſt be different in Colour and in Force, according to the Diſpoſition of the Bodies.

Such Deepenings which do not admit of any Light or Reflex, ought never to meet on the *Relievo* of any Member of any great elevated Part, but only in the Cavities or Joints of Bodies, the Folds of Draperies, *&c.* and alſo to find Occaſions for introducing great Shadows, to ſerve for the Repoſe of the Sight, and the looſening of things in the ſtead of many little Shadows, which have a poor Aſpect.

For the 2d, The Shadows that are made by Bodies, are either in plain or ſmooth Places, or on the Earth, in which they are deeper than the Bodies that occaſion them, as receiving leſs Reflex-Light, yet ſtill diminiſhing as they depart farther from the Cauſe, or on the neighbouring Bodies, where they muſt follow the Form of the ſaid Bodies, according to their Magnitude and Poſition, in reſpect to the Light.

For the 3d, Thoſe Shadows that have Parts, the Painter ought to obſerve to take the Teint or Luſtre of the light Part for a Light in a ſhadowed Place, and *e contra* the Teint or Luſtre in the Shadow in the lightened Part, in order to make an agreeable Aſſemblage of Colour, Shadow, and Reflex, in the ſhadowed Part; but this muſt be done without interrupting the great Maſſes of Shadows.

He ought to avoid forming little things in the Shadow, as not perceivable without being cloſely look'd at, and to work it, as it were, in the general, and at one Sight.

He ought never to ſet the ſtrong Shadows againſt the Lights, without ſoftening the harſh Contraſt, by the Help of ſome intermediate Colour, tho' the Maſs of the Light may be placed either before or behind that of the Shadow, yet it ought not to be ſo diſpoſed to illumine the principal Parts of the Subject.

For the 4th, The Effects of Shadows are different, as the Place is either wide and ſpacious, as in thoſe which come immediately from the Sun, which are pretty ſenſible, and their Extremes very abrupt, from the ſerene Air, which are fainter and more ſweet; from the dark Air, which appear more diffuſed, and almoſt imperceptible; and thoſe from an Artificial Light, which make the Shadows more deep, and their Edges abrupt; or, as it is more narrow and confin'd where the Lights coming from the ſame Place make the Shadow more ſtrong, and the Reflex leſs ſenſible.

CLAMEA *admittenda in Itinere per Atturnatum*, is a Writ whereby the King commands the Juſtices in *Eyre* to admit of one's Claim by *Attorney* that is employed in the King's Service, and cannot come in his own Perſon. *L.*

CLAMP-NAILS are ſuch Nails as are uſed to faſten on Clamps in building and repairing of Ships.

CLAMP [in a *Ship*] a Piece of Timber applied to a Maſt or Yard, to ſtrengthen it, and prevent the Wood from burſting.

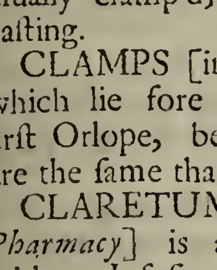
CLAMP'D. When a Piece of Board is fitted with the Grain to the End of another Piece of Board acroſs the Grain, the former Board is ſaid to be clamp'd. And thus are the Ends of Tables uſually clamp'd, to keep them from warping or caſting.

CLAMPS [in a *Ship*] are thoſe thick Timbers which lie fore and aft, under the Beams of the firſt Orlope, bearing them up at either End, and are the ſame that the Riſings are to the Deck.

CLARETUM [amongſt the Foreign Writers of *Pharmacy*] is an Aromatick Wine impregnated with an Infuſion, and ſweetened with Sugar; it is otherwiſe called *Vinum Hippocraticum*, *Hippocras Wine*; alſo, *Medicated Wine*: It is ſo called becauſe 'tis percolated and purified by a Wine-Sack or Bag, thro' which it is drained from its Dregs. And this Bag is called *Manica Hippocratis*.

CLARIFICATION is the way to make Juices, or thick Decoctions, become clearer and finer, which is done three Ways; by letting the Dregs ſubſide of themſelves, by Fermentation, or by the Addition of Vinegar, White of an Egg, or Milk, *&c.* either to precipitate the Dregs to the Bottom, or gather them in a Scum.

CLARIGATIO, ſo the *Civilians* call *Areſto facto ſuper bonis mercatorum alienigenorum*. Which ſee.



CLARION, a Bearing [in *Heraldry*] of the following Figure: *Ruby* 3 *Clarions Topaz*, being the Arms of the Earl of *Bath*, by the Name of *Greenville*. *Guillim* takes theſe *Clarions* to be a kind of old-faſhion'd Trumpets; but others think they rather repreſent the Rudder of a Ship; or, as ſome ſay, the Reſt for a Lance.

CLASP-NAILS are ſuch whoſe Heads are brought into a little Compaſs, ſo that they will ſink into the Wood, and when drove home, let a Smoothing-Plane go over them.

CLASPERS is the twiſted Ligaments or Threads with which certain Herbs or Shrubs, ſuch as *Briony* and *Vines*, takes hold of Trees or Plants that grow about them.

Theſe Claſpers are of a compound Nature between that of a Root and a Trunk. Their Uſe is ſometimes for Support only, as in the Claſpers of *Vines*, *Briony*, *&c.* whoſe Branches being long, ſlender, and fragile, would fall by their own and their Fruits Weight; but theſe Claſpers taking hold of any thing which is at hand (which they do by a natural Circumvolution which they have; thoſe of *Briony* have a retrograde Motion about every third Circle, in the Form of a double Claſp, ſo that if they miſs one Way they may catch the other). Sometimes the Uſe of Claſpers is alſo for the Supply, as in the Trunk-Roots of *Ivy*, which being a Plant that mounts very high, and being of a cloſer and more compact Subſtance than that of *Vines*, the Sap would not be ſufficiently ſupplied to the upper Sprouts, unleſs theſe aſſiſted the Mother Root; but theſe ſerve alſo for Support too: Sometimes they ſerve for Stabiliment, Propagation, and Shade; for the firſt of theſe ſerve the Claſpers of Cucumbers; for the ſecond, thoſe, or rather the Trunk-Roots of *Chamæmil*; and for all three, the Trunk-Roots of Strawberries, which mightily ſeem to delight in Shade.

CLAUDENT *Muſcles*, otherwiſe called *Semicircular*, are thoſe that ſhut the Eye-lids, being placed between the Inner-Membrane of that Part, and the Fleſhy-Membrane. Theſe two Muſcles being contracted ſhut up the Eye, the greater drawing down the Upper Eye-lid, and the leſs pulling up the lower, which falls down again thro' its own Gravity, and the Relaxation of its Fibres.

CLAVICULÆ, or *Channel Bones*, are two little Bones which are ſituated at the Baſis of the Neck, above the Breaſt, on each Side one. They are pretty long and ſmall, and at one End are joined to the Production of the *Scapulæ*, called *Acromion*, by a peculiar Articulation which they call *Synchondroſis*; at the other End they are joined to the upper Part of the *Sternum*, by an *Articulation* which they call *Arthrodia*. They are in the Shape of a long (*ſ*) for the Paſſage of the Veſſels which paſs under them, and to facilitate the Motion of the Arms. Their Uſe is to ſuſtain the *Scapulæ*, to which the Arms are articulated; and becauſe the pectoral Muſcle which pulls the Arm acroſs the Breaſt, is inſerted near the upper End of the Shoulder-Bone: If the *Claviculæ* did not keep the *Scapulæ*, to which the Head of the *Humerus* is always joined at an equal Diſtance from the *Sternum*, the upper Part of the Arm only, and not the Hand, muſt have been pulled forwards.

CLAVUS is a Pain in a ſmall Part of the Head, commonly above the Eye, in the Eye-brow, and ſeems as if that Part of the Head were bored thro' with a little Augur or Wimble. Dr. *Syndenham* calls ſuch a Pain in the Top of the Head of Hyſterical Perſons, *Clavus Hyſtericus*. *L.*

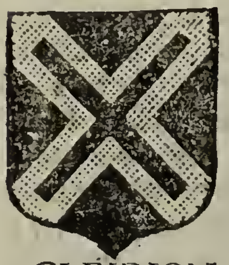
CLAUSUM *Fregit* ſignifies as much as an Action of Treſpaſs, and is ſo called, becauſe in the Writ ſuch a one is ſummoned to anſwer, *Quare clauſum fregit?* that is, *Why he did ſuch a Treſpaſs?*

CLAYES, or *Wattles*, a Term in *Fortification*. See *Hurdles*.

CLEAR *Viſion*. See *Viſion*.

CLEAR [in *Building*] a Term uſed by Workmen for the In-ſide Work of a Houſe.

CLEAT is a Piece of Wood faſtened to the Yard-Arm of a Ship, to keep the Ropes from ſlipping off the Yard.



CLECHE, a Term [in *Heraldry*] for any Ordinary being pierced thro' with the ſame Figure as here. He beareth *Gules*, a *Saltier Cleche*, that is, one pierced through with another.

CLEIDION [Κλειδίον, *Gr.*] the ſame with *Clavicula*.

CLENCH-NAILS are ſuch as will drive without ſplitting the Boards, and draw without breaking. They are uſed by Boat and Barge-Builders, and are proper for any Building with Boards that muſt be taken down again; for fine Work, they are made with Claſp-heads.

CLEPSYDRA [Κλεψύδρα, *Gr.*] an Inſtrument anciently uſed (eſpecially among the *Ægyptians*) to meaſure Time by the running of Water out of one Veſſel into another; firſt invented by *Scipio Manſica*, or at leaſt brought firſt by him to *Rome*; for *Pierius* in his *Hieroglyphicks*, tells us, The Prieſts of *Acanta*, a Town beyond the River *Nile* in *Ægypt*, did uſe every Day to pour Water into a Veſſel, by the dropping of which thro' a ſmall Hole, they meaſured Time.

There were many Kinds of them, but all had this in common, That the Water ran gently thro' a narrow Paſſage from one Veſſel into another; and in the lower was a Piece of Cork, or light Wood, which, as the Veſſel filled, roſe up by Degrees, and ſo ſhewed the Hour.

Plutarch obſerves one Inconvenience in theſe *Water-Clocks*; *i. e.* that the Air, according to its different Temperature, as to Heat, Cold, Denſity, or Rarity, had an Influence on the running of the Water, ſo that it muſt meaſure Time unequally: And another greater there was, which a good while was unheeded, *viz.* that the Water always ran ſlower out according as its Quantity and Preſſure in the Veſſel abated: To remedy this, the *Orontes* invented a *Clepſydra* in the Form of a ſmall Ship floating on the Water, and which emptied itſelf by means of a Syphon placed in the Middle of it; but which way the Hours by this means were made equal I cannot find, the Deſcriptions given of the Thing being very obſcure.

Some of theſe *Clepſydræ* were ſo made, as that, without changing the Dial, the Hours were ſometimes longer, and ſometimes ſhorter, by means of an Inequality in the Index, or Hand, and which *Vitruvius* ſays, depended on the Management of the Water; for in the long Days they made the Hole narrower, and ſo the Water ran proportionably ſlower; and in the Winter, when the Days were ſhort, the Hole was made larger, which made the Water flow the faſter, and ſo the Index turned round alſo the faſter.

In the Memoirs of the *French Royal Academy* for *April* 1699, there is an Account, by Mr. *Varignon*, of a General and Geometrick Method to make *Clepſydræ*, or *Water-Clocks*, with any kind of given Veſſels, and for any given Orifices for the Water to iſſue out at, and according to any given Velocity of the Water's Deſcent.

Conſtruction of the Clepſydra.

PROBLEM.

To divide any given Cylindrick Veſſel into Parts, to be empty'd in each Diviſion of Time, the Time wherein the whole, and that wherein any Part is to be evacuated, being given.

Suppoſe, *v. g.* a Cylindric Veſſel, whoſe Charge of Water flows out in twelve Hours, were required to be divided into Parts, to be evacuated each Hour: 1. As the Part of Time 1 is to the whole Time 12, ſo is the ſame Time 12 to a fourth Proportional 144. 2. Divide the Altitude of the Veſſel into 144 equal Parts; here the laſt will fall to the laſt Hour, the three next above to the laſt Part but one, the five next to the tenth Hour, *&c.* Laſtly, the 23 laſt to the firſt Hour.

For ſince the Times increaſe in the Series of the natural Numbers, 1, 2, 3, 4, 5, *&c.* and the Altitudes, if the Numeration be in a retrograde Order from the twelfth Hour, increaſe in the Series of the unequal Numbers, 1, 3, 5, 7, 9, *&c.* the Altitudes computed from the twelfth Hour, will be as the Squares of the Times, 1, 4, 9, 16, 25, *&c.* Therefore the Square of the whole Time 144, comprehends all the Parts of the Altitude of the Veſſel to be evacuated. But a third Proportional to 1 and 12, is the Square of 12; and conſequently it is the Number of equal Parts in which the Altitude is to be divided, to be diſtributed according to the Series of the unequal Numbers, thro' the equal Intervals of Hours.

Since, in lieu of Parts of the ſame Veſſel, other leſs Veſſels equal thereto may be ſubſtituted, the Altitude of a Veſſel emptied in a given Space of Time being given, the Altitude of another Veſſel to be emptied in a given Time may be found, *viz.* by making the Altitudes as the Squares of the Times.

CLERICO *admittendo* is a Writ directed to the Biſhop, for the admitting of a Clerk to a Benefice upon a *ne admittas*, tried and found for the Party that procureth the Writ. *L.*

CLERICO *capto per Statutum Mercatorum*, *&c.* is a Writ directed to the Biſhop, for the Delivery of a Clerk out of Priſon, that is in Cuſtody upon the Breach of a *Statute Merchant*.

CLERICO *convicto commiſſo Eccleſiæ in defectu Ordinarii deliberando*, *&c.* is a Writ for the Delivery of a Clerk to his Ordinary that formerly was convicted of Felony, by reaſon his Ordinary did not challenge him according to the Privileges of a Clerk. *L.*

CLERICO *infra Sacros Ordines Conſtitutio non elegendo in Officium*, is a Writ directed to the Bailiffs, *&c.* that have thruſt a Bailiwick or Beadleſhip upon one in Holy Orders, charging them to releaſe him again.

CLERK. This Word did anciently ſignify a Secular Prieſt, in Contradiſtinction to a Religious, or a Regular; but by Degrees it came to be in general attributed to every Scholar, and at laſt was common to every Scribe and Notary; and hence ſo many of our Law Officers have the Title of *Clerk*.

CLERK *Controller of the King's Houſe* (whereof there be two) is an Officer in Court, that hath a Place and Seat in the Counting-Houſe, and Authority to allow or diſallow the Charges or Demands of Purſuivants, and Meſſengers of the *Green-Cloth*, Purveyers, or the like: He hath alſo the Overſight and Controlling of all Defaults, Defects, and Miſcarriages of any of the inferior Officers, and ſits in the Counting-Houſe with the ſuperior Officers, *viz.* the Lord Steward, Treaſurer, Controller, and Cofferer, either for correcting or bettering of things out of Order, with ſeveral other Matters.

CLERK *of the Acts* is an Officer of the Navy, who receives and enters the Commiſſions and Warrants of the Lord Admiral, and regiſters the

Acts and Orders of the Commiſſioners of the Navy.

CLERK *of the Aſſize* is he that writeth all things judicially done by the Juſtices of Aſſize in their Circuits.

CLERK *of the Check* is an Officer in Court ſo called, becauſe he hath the Check and Controlment of the Yeomen of the Guard, and all other ordinary Yeomen or Uſhers, belonging either to the King, Queen, or Prince, either giving Leave, or allowing their Abſences, or Defects in Attendance; or diminiſhing their Wages for the ſame.

CLERK *of the Crown* is a Clerk or Officer in the King's-Bench, whoſe Buſineſs is to read, frame, and record all Indictments againſt Traitors, Felons, and other Offenders there arraigned upon any publick Crime. He is otherwiſe called *Clerk of the Crown-Office*, or *Clerk of the Crown in the King's-Bench*.

CLERK *of the Crown in Chancery* is an Officer there, that by himſelf, or his Deputy, is continually to attend the Lord-Chancellor, or Lord-Keeper, for ſpecial Matters of State, by Commiſſion, or the like, either immediately from his Majeſty, or by Order of his Council, as well ordinary as extraordinary: Alſo all general Pardons upon Grants of them at the King's Coronation, or at a Parliament, the Writs of Parliament, with the Names of Knights and Burgeſſes, are returned into this Office. He hath alſo the making of ſpecial Pardons, and Writs of Execution, upon Bonds of *Statute Staple* forfeited.

CLERK *of the Errors* [in the Court of *Common-Pleas*] does tranſcribe and certify into the King's-Bench, the Tenor of the Records of the Cauſe or Action upon which the Writ of Error (made by the Curſitor) is brought there to be judged and determined.

CLERK *of the Errors* [in the *King's-Bench*] does likewiſe tranſcribe and certify the Records of ſuch Cauſes in that Court into the Exchequer, if the Cauſe or Action were by Bill.

CLERK *of the Errors* [in the *Exchequer*] does tranſcribe the Records certified thither out of the King's-Bench, and prepares them for Judgment in the Court of Exchequer, to be given by the Juſtice of the Common-Pleas, and Barons there.

CLERK *of the Eſſoigns* is an Officer belonging to the Court of Common-Pleas, who only keepeth the Eſſoign-Roll, and hath, for entering every Eſſoign, Six-pence, and for every Exception to bar the Eſſoign, in Caſe where the Party hath omitted his time, Six-pence. He hath alſo the providing of Parchment, and cutting it into Rolls, and making the Number upon them, and Delivery out of all the Rolls to every Officer, and receiving them again when they be written.

CLERK *of the Eſtreats* belongs to the Exchequer, and (every Term) receiveth the Eſtreats out of the Lord-Treaſurer's Remembrancer's Office, and writeth them out to be levied for the King: He alſo maketh Schedules of ſuch Sums eſtreated as are to be diſcharged.

CLERK *of the Hamper*, or *Hanaper*, or *Warden of the Hamper*, is an Officer in the Chancery, whoſe Buſineſs is to receive all Money due to the King's Majeſty for the Seals of Charters, Patents, Commiſſions, and Writs; as alſo Fees due to the Officers for enrolling and examining the ſame. He is obliged to attend on the Lord-Chancellor, or the Lord-Keeper (daily) in Term-time, and at all times of Sealing.

CLERK *of the Juries*, or *Curata Writs*, is an Officer belonging to the Court of Common-Pleas, which maketh out the Writs called *Habeas Corpora*, and *Diſtringas*, for the Appearance of the Jury either in Court or at Aſſizes, after that the Jury or Pannel is returned upon the *Venire facias*.

CLERK *of the King's Great Wardrobe*, is an Officer of the King's Houſe, that keepeth an Account or Inventory, in Writing, of all things belonging to the King's Wardrobe.

CLERK *of the King's Silver*, is an Officer belonging to the Common-Pleas, to whom every Fine is brought, after it has been with the *Cuſtos Brevium*, and by whom the Effect of the Writ of Covenant is entered into a Paper-Book, and, according to that Note, all the Fines of that Term are alſo recorded in the Rolls of the Court.

CLERK *of the Market*, is an Officer of the King's Houſe, whoſe Duty is to take Charge of the King's Meaſures, and to keep the Standards of them; that is, Examples of all the Meaſures that ought to be thro' the Land.

CLERK *Marſhal of the King's Houſe*, ſeems to be an Officer that attends the Marſhal in his Court, and recordeth all his Proceedings.

CLERK *of the Nichils*, or *Nihils*, is an Officer in the Exchequer, that maketh a Roll of all ſuch Sums as are nichiled by the Sheriff upon their Eſtreats of Green Wax, and delivereth the ſame into the Lord-Treaſurer's Remembrancer's Office, to have Execution done upon them for the King.

CLERK *of the Outlawries*, is an Officer belonging to the Court of Common-Pleas, being a Deputy to the King's Attorney-General, for making out the Writs of *Capias utlegatum* after Outlawry; and the King's Attorney's Name is to every one of thoſe Writs. And whereas Seven-pence is paid for the Seal of every other Writ betwixt Party and Party, there is but a Penny paid for the Seal of this, becauſe it goes out at the King's Suit.

CLERK *of the Parliament*, is he that recordeth all Things done in the High Court of Parliament, and engroſſeth them fairly into Parchment Rolls, for their better keeping to Poſterity. Of theſe there be two, one of the Higher, the other of the Lower, or Houſe of Commons.

CLERK *of the Peace*, is an Officer belonging to the Seſſions of the Peace. His Duty is at the Seſſions to read the Indictments, to enroll the Acts, and draw the Proceſs, to enroll Proclamations of Rates for Servants Wages, to enroll the Diſcharge of Apprentices, to keep the Counter-part of the Indenture of Armour, *&c.* alſo to certify in the King's Bench, Tranſcripts of Indictments, Outlawries, Attainders, and Convictions, had before the Juſtices of the Peace within the Time limited by Statute.

CLERK *of the Pell* belongs to the Exchequer, whoſe Buſineſs is to enter Tellers Bills into a Parchment-Roll, called *Pellis Receptorum*, and alſo to make another Roll of Payment, called *Pellis Exituum*, wherein he ſetteth down by what Warrant the Money was paid.

CLERK *of the Petty Bag* is an Officer in Chancery, whereof there are Three, and the Maſter of the Rolls their Chief. Their Office is to record the Return of all Inquiſitions out of every Shire, all Liveries granted in the Court of Wards, all *Ouſter les mains*, to make all Patents of Cuſtomers, Gaugers, Controllers, and Aulnagers, Summons of the Nobility, Clergy, and Burgeſſes, to the Parliament; Commiſſions directed to Knights, and others, of every Shire, for ſeiſing of Subſidies;

Writs for Nomination of Collectors for the Fifteenths, and all Tranſverſes upon any Office, Bill, or otherwiſe, and to receive the Money due to the King for the ſame.

CLERK *of the Pipe* belongs to the Exchequer, who, having all Accounts and Debts due to the King delivered and drawn out of the Remembrancer's Office, chargeth them down into the great Roll, who alſo writeth Summons to the Sheriff to levy the ſaid Debts upon the Goods and Chattels of the ſaid Debtors; and if they have no Goods, then doth he draw them down to the Lord-Treaſurer's Remembrancer, to write Eſtreats againſt their Lands.

CLERK *of the Pleas* is an Officer in the Exchequer, in whoſe Office, the Officers of the Court, upon ſpecial Privileges belonging to them, ought to ſue, or be ſued, upon any Action.

CLERK *of the Privy-Seal* (whereof there be four) that attendeth the Lord-Keeper of the Privy-Seal; or if there be none ſuch, upon the Principal Secretary, writing or making out all things that be ſent by Warrant from the Signet to the Privy-Seal, and are to be paſs'd to the Great-Seal; as alſo to make out Privy-Seals upon any ſpecial Occaſion of his Majeſty's Affairs, as for Loan of Money, and ſuch like.

CLERK *of the Sewers* is an Officer belonging to the Commiſſioners of the Sewers, writing all things that they do by Virtue of their Commiſſion. See *Sewers*.

CLERK *of the Signet* is an Officer continually attending upon his Majeſty's principal Secretary, who always hath Cuſtody of the Privy-Signet, as well for ſealing his Majeſty's private Letters, as alſo ſuch Grants as paſs his Majeſty's Hand, by Bills ſigned. Of theſe there be four that attend in their Courſe, and have their Diet at the Secretary's Table.

CLERK *of the Treaſury* belongs to the Common-Pleas, and hath the Charge of keeping the Records of *Niſi prius*, hath the Fees due for all Searches, and hath the certifying of all Records into the King's-Bench, when a Writ of Error is brought, and maketh out all Writs of *Superſedeas de non moleſtando*, which are granted for the Defendants, while the Writ of Error hangeth: Alſo he maketh all Exemplifications of Records being in the Treaſury.

CLERK *of the Warrants* is an Officer belonging to the Court of Common-Pleas, which entereth all Warrants of Attorney for Plaintiff and Defendant, and enrolleth all Deeds of Indentures of Bargain and Sale which are acknowledged in Court, or before any Judges out of the Court.

CLEW [of the *Sail* of a *Ship*] is the lower Corner of it which reaches down to that Earing where the Tackles and Sheets are faſtened; ſo that when a Sail is made goaring, or ſloping by Degrees, ſhe is ſaid to have *a great Clew*: And a Ship is ſaid to *ſpread a great Clew* when ſhe hath a very long Yard, and ſo hath much Canvas in her Sails.

CLEW-GARNET is a Rope faſtened to the Clew of the Sail, and from thence runs in a Block ſeized to the Middle of the Main and Fore-yard: Its Uſe is to hale up the Clew of the Sail cloſe to the Middle of the Yard, in order to its being furled.

CLEW-LINE is the ſame to the Top-ſails, Top-gallant-ſails, and Sprit-ſails, that the Clew-garnet is to the Main-ſail and Fore-ſail, and has the very ſame Uſe. In a Guſt of Wind, when a Top-ſail is to be taken in, firſt hale home the Lee Clew-line, and then the Sail will be taken in the eaſier.

CLIFF, or *Cleff*, a Term [in *Muſick*] ſignifying a certain Mark from the Poſition whereof the proper Places of all other Notes in any Song or Leſſon are underſtood, by proving the ſaid Notes from thence according to the Scale of the *Gamut*, wherein are contained three Septenaries of Letters, *viz.* G, A, B, C, D, E, F; which ſeven Letters of the Alphabet ſet at the Beginning of every Rule and Space, repreſents as many Cliffs; but of theſe four are only uſed, and generally placed at the Beginning of the Staves of every Leſſon, either Vocal or Inſtrumental.

The firſt is called *F-a-ut Cliff*, and appropriated only to the Baſs, or loweſt Part.

The ſecond is *C-ſol-fa-ut Cliff*, peculiar to the inner Parts, as, the Tenor and Counter-Tenor.

The third is *G-ſol-re-ut Cliff*, which is only ſet for the Treble or higheſt Part.

The fourth is *B-Cliff*, or *B-fa-b-mi Cliff*, which is proper to all Parts, and ſerves for the flatting and ſharping of Notes.

CLIMACTERICAL *Years*, are certain obſerveable Years, which are ſuppoſed to be attended with ſome grand Mutation of Life or Fortune; as, the 7th Year, the 21ſt (made up of three times ſeven) the 49th (made of 7 times 7) the 63d (being 9 times 7) and the 81ſt (which is 9 times 9) which two laſt are called *Grand Climactericks*. *Aulus Gellius* ſaith, This Whim came from the *Chaldeans* firſt, and 'tis probable *Pythagoras* had it from them, who uſed to talk much of the Efficacy of the Number 7, with which he was mightily in love.

CLIMATE is a Space on the Terreſtrial Globe comprehended between two Circles parallel to the Equator; ſo that from the Beginning of the Climate to that of another next to it, there is Half an Hour's Difference in the longeſt Summer-day. Each Climate alſo is divided into two Half Climates by a parallel Circle, which Half Climate is called a Parallel Circle, which Half Climate is call'd a Parallel; wherefore theſe Parallels muſt differ from one another one Fourth of an Hour in the longeſt Days.

The Earth is divided, in reſpect of the various Length of Days, into Climates. A Climate is a Space of the Earth (parallel to the Equator) whoſe longeſt Day exceeds the longeſt Day of the preceeding Climate by Half an Hour: And whereas the Ancients reckoned but ſeven Climates on each Side of the Equator, *viz.* to 50° 30′ Latitude, there are now reckoned 30, even up to the Poles, according to the following Table, wherein the Degrees of Latitude ſhew the Ends of the Climates they are ſet oppoſite to, and conſequently the Beginnings of the Climates immediately following. Thus the firſt Climate beginning at the Equator, ends at 8° 25′ Latitude, where the ſecond begins, and ends at 16° 25′ Latitude, *&c.*

Climates.	Quantity of the longeſt Day.		Latitude.	
	Hour.	*Min.*	*Deg.*	*Min.*
0	12	00	00	00
1	12	30	08	25
2	13	00	16	25
3	13	30	23	50
4	14	00	20	30
5	14	30	36	28
6	15	00	41	22
7	15	30	45	29
8	16	00	49	01
9	16	30	51	58
10	17	00	54	27
11	17	30	56	37
12	18	00	58	29
13	18	30	59	58
14	19	00	61	18
15	19	30	62	25
16	20	00	63	22
17	20	30	64	06
18	21	00	64	49
19	21	30	65	21
20	22	00	65	47
21	22	30	66	06
22	23	00	66	20
23	23	30	66	28
24	24	00	66	21

Months	1	2	3	4	5	6
Latitude	67° 15′	69° 30′	73° 20′	78° 20′	84° 10′	90°

It is apparent, that by the foregoing Table, the Length of the longeſt Day in any Latitude may be eaſily found: For Example, *Madrid* being in Latitude 40° 10′, it appears by the Table, that it lies within the ſixth Climate, and its longeſt Day is near 15 Hours; whereas *Stockholm*, in Latitude 59° 33′, lies within the thirteenth Climate, and its longeſt Day is near 18 Hours and a Half.

The Inhabitants of this Earth are alſo conſidered with reſpect to the Poſition of the Horizon with the Equator, which is three-fold; *viz.* either right, cutting it at Right-angles, or it is oblique, or elſe it is parallel, and does not cut it at all, but coincides with it; ſuch as have the firſt of theſe Poſitions are ſaid to inhabit a Right-Sphere; ſuch as have the ſecond, an Oblique; and ſuch as have the third, a parallel Sphere.

CLIMAX [Κλιμαξ, *Gr.* a *Gradation*] a Figure in Rhetorick whereby we aſcend or deſcend by Degrees.

CLINCH [of a *Cable*] is that Part of it which is bended about the Ring of the Anchor, and then ſeized or made faſt.

CLINCH-BOLTS [in a *Ship*] are ſuch as are clinched with a reveting Hammer at thoſe Ends which come through.

CLINCHING is a kind of ſlight Calking uſed at Sea in a Proſpect of foul Weather, about the Ports, which is, to drive a little Oakam into their Seams, that the Water may not come in at them.

CLINOIDES are four Proceſſes in the In-ſide of the *Os Splenoides*, forming a Cavity called *Cella Turſica*, in the Middle of that Bone, in which lies the *Glandula Pituitaria*.

CLITORIS is a Part in the *Pudendum Muliebre*, ſeated before; 'tis a long round Body, naturally about the Bigneſs of the *Uvula*: It lies within the Skin, nor doth any Part of it appear outwardly, but juſt its Extremity, which is covered with a Folding of the Skin made by the Union of the *Nymphæ*, and is called its *Præputium*. The Subſtance of it conſiſts of two ſpongy Bodies like thoſe of the *Penis*. They riſe at two different Places in the lower Part of the *Os Pubis*, and approaching on to the Body of the *Clitoris*, whoſe Extremity, which is of an exquiſite Senſe, is called its *Glans*. The two ſpongy Bodies, before they unite, are called by ſome the *Crura Clitoridis*, and they are twice as long as the Body of the *Clitoris*. It hath two Muſcles ariſing from the Protuberance of the *Iſchium*, and are inſerted in its ſpongious Bodies; they are called *Erectores Clitoridis*, becauſe they have the ſame Uſe as the *Erectores Penis*. The *Clitoris* hath Veins and Arteries from the Hæmorhoidal Veſſels and the *Pudenda*, and Nerves from the intercoſtal Pair.

CLOATHED. The Seamen ſay a Maſt is cloathed when the Sail is ſo long as to reach down to the Gratings of the Hatches, ſo that no Wind can blow below the Sail; and they ſay a Ship ſpreads much Cloth, when ſhe hath broad Sails.

CLOCKS and *Clock-work*. How to calculate all the Numbers and Proportions for any Movement, *&c.* ſee under *Watch-work*.

CLOSE. When any Bird is drawn in a Coat of Arms with its Wings cloſe down about it (*i. e.* not diſplayed) and in a ſtanding Poſture, they blazon it by this Word *Cloſe*; but if it be flying, they call it *Volant*.

CLOSE [in *Muſick*] See *Cadence*.

CLOSE-FIGHTS are [a-board a *Ship*] ſuch Bulk-heads as are, in a cloſe Fight, put up Fore and Aft in the Ship, for the Men to ſtand behind them ſecure, and fire upon the Enemy; and if the Ship is boarded, to ſecure or clear the Decks.

CLOSETT, a Term [in *Heraldry*] ſignifying the Half of a Barr, and the Barr ought to contain one Fifth-part of the Eſcutcheon, as the *Feſſe* doth the third. See *Feſſe*.

CLOUDS are a Congeries of (chiefly) watery Particles, drawn or ſent out of the Earth in Vapours, which, when theſe Particles are very nearly placed to one another, appear denſe and thick; but when they are more remote, are clear and bright, and ſometimes almoſt tranſparent.

It hath been frequently Matter of Diſpute amongſt Naturaliſts, how theſe Clouds are ſuſpended in a Medium, which muſt be lighter ſpecifically than themſelves. But 'tis eaſy to conceive, that the Parts which compoſe Clouds are ſo many little Bubbles, having a watery Skin over a little Sphere of fluid Matter lighter than Air, and therefore may eaſily, like the Bubbles of Soap and Water which the Children blow up with a little Pipe, be ſupported by the Air; but whenever they are broken, by the violent Agitation of Winds, or are driven againſt the Sides of Hills, *&c.* they muſt change their Form of Bubbles, and fall down in Rain. See the Word *Vapour*.

Mr. *Boyle* ſaith, An excellent Aſtronomer aſſured him, that tho' he had many times accuratly meaſured the Height of the Clouds, yet he could never find any (even white ones) to be three Fourths of a Mile high, and few did exceed Half a Mile.

CLOVE is a Weight of Cheeſe containing the 32d Part of the Weight; and is 8 Pound by 9, *H.* 6. *c.* 8.

CLOUTS are thin Plates of Iron nailed on that Part of the Axle-tree of a Gun-Carriage, which comes thro' the Nave, thro' which the Lins-pin goes.

CLOUT-NAILS are ſuch as are commonly uſed for nailing on of Clouts (or Plates of Iron) to the Axle-trees of Carriages, and are proper to faſten any Iron to Wood.

CLOYED. The Seamen ſay, when any thing is got into the Touch-hole of a Great Gun, ſo that they cannot with a Priming-Iron make way for the Powder to be put in to prime her, *The Touch-hole is cloyed*; wherefore when Guns are nailed, *&c.* they ſay, *they are cloyed.*

CLYDON is a Fluctuation of the Ventricle.

CLYPEAL *Cartilage.* See *Thyroides.*

CLYPEI-FORMIS, a ſort of Comets reſembling a Shield. See *Diſcus.*

CLYSMA, the ſame with *Clyſter.*

CLYSSUS [amongſt ſome *Chymiſts*] is a long Digeſtion and Union of the Oily Spirits (eſpecially Mineral ones) together, in order to make a Compoſition or accurate Mixture of them. Sometimes 'tis taken for an Extraction and Union of the more ſubtile Parts of any Plant, *Vid. Rolſink. Chym. Lib.* 3 *Sect.* 2 *Schroder. Lib.* 3. *c.* 17. ſometimes for a Medicine made of the moſt active and energetical Parts of any Ingredients.

CLYSTER [Κλυςὴρ, *Gr.*] a liquid Remedy or Injection introduced into the Inteſtines, by the Fundament, to looſen the Belly, refreſh the Inteſtines, diſſipate Wind, and to moiſten and ſoften the Fæces, *&c.*

CNEMODACTYLUS [of Κνήμι the *Leg*, and δακτυλος, *Gr.*] a *Muſcle* otherwiſe called *Extenſor tertii internodii digitorum.*

COACERVATE *Vacuum.* See *Vacuum.*

COACH is the Council-Chamber on-board a Flagg-ſhip.

COAGULATE ſignifies [in *Chymiſtry*] to give a Conſiſtence to Liquors by evaporating ſome Part of them over the Fire, or elſe by mixing Liquors together, which are of different Natures, to effect the ſame thing; by either of which, and many other ways, a Coagulation may be effected.

COALITION is the gathering together and uniting into ſenſible Maſſes, the minute Corpuſcles which compoſe any concrete and natural Body. *Coaleſcency* is commonly taken for the ſame.

COAMINGS [aboard a *Ship*] are thoſe Planks, or that Frame, which raiſes up the Hatches higher than the reſt of the Deck, in which Loop-holes for Muskets to ſhoot out at are uſually made, in order to clear the Deck of the Enemy when a Ship is boarded.

COASTING is that Part of Navigation where the Places aſſign'd are not far diſtant, ſo that a Ship may ſail in ſight of Land, or within Soundings, between them.

For the Performance of which there is only required good Knowledge of the Land, the Uſe of the Compaſs, and Lead or Sounding-line; ſuch are the Voyages on the narrow or *Britiſh* Seas, between *England*, *Holland*, and *France*, alſo all about the *Baltick* Seas; and thoſe in the *Mediterranean* are little elſe.

COAT [by *Anatomiſts*] is taken for a membranous Cover of any Part of the Body, as the Coats of the Eye, Nerves, Arteries, *&c.*

COATS [in a *Ship*] are Pieces of tarr'd Canvaſs which are put about the Maſts at the Partners; they are alſo put about the Pumps at the Decks, that no Water may go down there; and theſe are alſo uſed at the Rudder's Head.

COCCYGÆUS is a Muſcle of the *Os Coccygis*, ariſing *Tendino-Carnous* from the acute Proceſs of the *Os Iſchium*, between the Ligament that reaches from thence to the *Os Sacrum*, and one of the Heads of the *Gemini*; from a narrow Beginning it gradually dilates itſelf into a thin fleſhy Belly interſperſed with ſome tendinous Fibres. It is inſerted into the whole Length of the *Os Coccygis*, laterally.

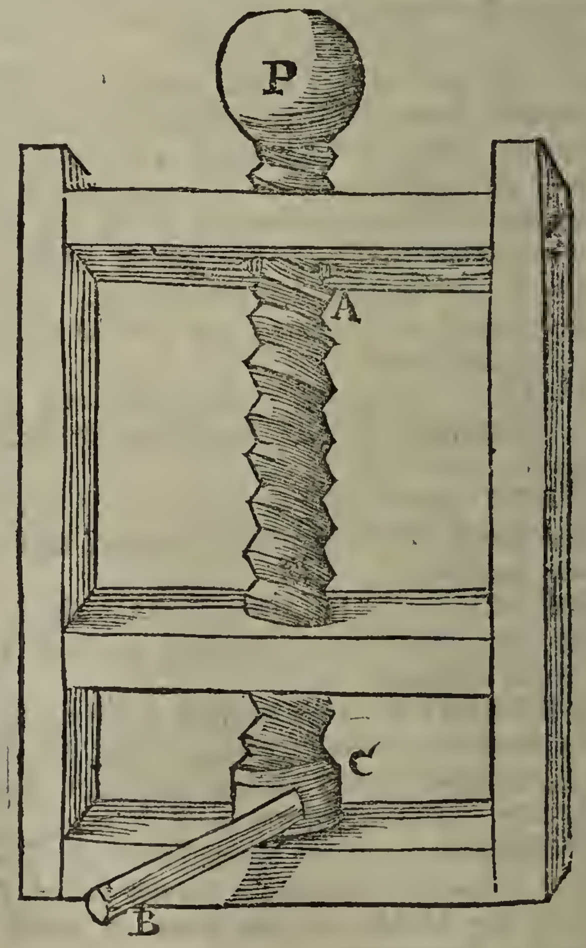
Its Uſe is to draw that inwards or forwards after the Excretion of hardened *Fæces*, *&c.* This Muſcle was firſt diſcovered by Dr. *Douglas*; ſee his *Myogr. Comp. Specim.*

COCCYGIS OS is a cartilaginous kind of Bone joined to the Extremity of the *Os Sacrum*; it is compoſed of three or four Bones, of which the lower is ſtill leſs than the upper, till the laſt end in a ſmall Cartilage, and it reſembles a little Tail turn'd inwards: Its Uſe is to ſuſtain the *Rectum Inteſtinum*; it yields to the Preſſure of the Fætus in Women in Travail, and therefore Midwives uſe to thruſt it backwards; but ſometimes they do it ſo rudely and violently, that it occaſions very great Pain, and ſeveral bad Effects: 'Tis called *Os Coccygis* becauſe it is in Shape ſomething like a Cuckow's Bill; its Bones are ſpongy and ſoft, and have neither Proceſs nor Cavity; for the Spinal Marrow deſcends no farther than the Bottom of the *Os Sacrum*, which terminates in the firſt Bone of the *Os Coccygis.*

COCCYX is the ſame with the *Coccygis Os*; which ſee.

COCHLEA is a Cavity of the inner Part of the Ear, ſo called from its Windings and Turnings, for it has three or four Rings which mutually ſucceed one another; it is girt about with a very ſoft and thin Membrane. See *Ear.*

It is alſo one of the Mechanical Powers, conſiſting of a Cylinder ſulcated or hollowed in a ſpiral Manner, and moving or turning in a Box or Nut, cut ſo as to anſwer to it exactly. Now the Power or Force of this Engine may be thus eſtimated: Suppoſe, in the Figure annexed, the Weight P to be raiſed by the Turn of the Male Screw C A, by means of the Handle or Lever B C. 'Tis plain that in one Revolution of the Cylinder A C,



the Weight can be raiſed no more than is the Diſtance between any two of the adjoining Leaves of the Screw; and that the Power moves as far as is the Compaſs of one Revolution; that is, the Way of the Power to that of the Weight in the ſame time, is as the Ambit of the Power in one Revolution of the Cylinder, to the Diſtance between any two contiguous Leaves of the Screw. Wherefore the Celerity of the Power to that of the Weight will be in the ſame Ratio. And conſequently, if you apply a Power which ſhall be to the Weight to be raiſed as the Way of that Power in each Revolution ſhall be to the aforeſaid Diſtance between any two next adjoining Leaves of the Screw, the Power ſhall be in Æquilibrio with the Weight; and therefore being increaſed ever ſo little more ſhall raiſe it. This Power is plainly a Combination of the Lever and Axis in Peritrochio together.

COCKET is a Seal appertaining to the King's Cuſtom-houſe: And alſo a Scroll of Parchment ſealed and delivered by the Officers of the Cuſtom-houſe to Merchants, as a Warrant that their Merchandize be cuſtomed. This Word is uſed alſo in the Statutes of Bread and Ale, made 15 *H.* III. where there is mentioned *Cocket-Bread*, among ſeveral other kinds; and it ſeems to have been hard Sea-Bisket, which perhaps had then ſome *Cocket-Mark* or *Seal*; or elſe was ſo called from its being deſigned for the Uſe of *Cock-ſwains* or Seamen.

COCKS [aboard a *Ship*] are little ſquare Pieces of Braſs with Holes in them, and put into Wooden Shivers, to keep them from ſplitting and galling by the Pins of the Blocks in which they move.

COCK-WATER is a Stream of Water brought in a Trough thro' a long Pole, in order to waſh out the Sand of the Tin-Ore into the Launder, while it is bruiſing in the Coffer of a Stamping-Mill. See *Tin.*

COCKPIT [in a *Man of War*] is a Place on the lower Floor or Deck, abaft the main Capſtan, lying between the Platform or Orlop and the Steward's Room, where are Subdiviſions or Partitions for the Purſer, the Surgeon, and his Mates.

COCK-SWAIN, or *Cockſon*, is an Officer aboard a Man of War, who hath the Care of the Barge or Shallop, and all things belonging to it, to be always ready with his Boat's Gang or Crew, and to Man the Boat on all Occaſions: He ſits in the Stern of the Boat and ſteers, and hath a Whiſtle to call and encourage his Men.

CODE [from the *Latin* Word *Caudex*, the Trunk or Timber of a Tree, comes *Codex*] which ſignifies a Volume or Book, becauſe anciently their Books were made of Wood, and the Leaves were almoſt like thoſe of our preſent Table-Books. The Emperor *Juſtinian* collecting together all the Pleas and Anſwers of the ancient Lawyers (which in thoſe Days were in looſe Scrolls or Sheets of Parchment or Paper) compiled them into a Book, which therefore he called *Codex*; and this Book of the Emperor hath ever ſince, by way of Eminence, been called the *Code*, which is accounted the ſecond Volume of the Civil-Law, and contains twelve Books; the Matter of which is nearly the ſame with that of the *Digeſt*, eſpecially the firſt eight Books; but it differs from it in this, that its Stile is by no means ſo pure, nor its Method ſo accurate as that of the *Digeſt*; and that it determines Matters of daily Uſe; whereas the *Digeſt* diſcuſſes the more abſtruſe and ſubtle Queſtions of the Law, giving you the various Opinions of the ancient Lawyers thereupon; and therefore hath more of polite, fine, and witty Arguing in it, than things of Benefit and Uſe to the Generality of Mankind.

The *Code* is compiled from the Anſwers and Determinations of 56 Emperors and their Councils, whereof many Perſons were learned and skilful Lawyers, as the famous *Papinian*, and ſome others, eſpecially from the time of *Adrian* to *Juſtinian* himſelf: And the Reaſon why this Emperor gave himſelf this new Trouble, was, becauſe he found the *Digeſt* in many Places too fine and ſubtile for common Uſe, and alſo very imperfect in that Reſpect, as by no means deciding abundance of Caſes that do every Day occur. Theſe Defects he deſigned to remedy by ſetting out the Code, where abundance of things before omitted, or too briefly handled, are there fully and diſtinctly determined.

There is another *Code* called the *Theodoſian Code*, of good Uſe to this Day; for there is no underſtanding the former Code without its Help: And this was formerly of ſuch Authority, that, as Mr. *Selden* and ſome others tells us, it was for ſeveral hundred Years in Uſe in the Weſtern Parts of *Europe*, when that Law was in a manner diſguiſed and forgotten: But now the *Theodoſian Code* is as much antiquated.

CODIA are the Tops of Poppies, of which they make Syrup; whence the Word *Diacodium* or *Syrupus de Meconio.*

CODICIL is a Schedule or Supplement to a Will or other Writing. 'Tis uſed as an Addition to a Teſtament, when any thing is omitted which the Teſtator would add, explain, alter, or retract, and is of the ſame Nature with a Teſtament, but that it is without an Executor: So that a Codicil is a leſs ſolemn Will of one that dies either teſtate or inteſtate, without the Appointment of an Heir: Teſtate, when he that made his Codicil hath either before or afterwards made his Teſtament, on which that Codicil depends, as to which it refers: Inteſtate, when one leaves behind him only a Codicil without a Teſtament, wherein he gives Legacies only to be paid by the Heir at Law, and not by any Heir inſtituted by a Will or Teſtament. Codicils firſt came in Uſe in the time of *Auguſtus*. A Codicil, as well as a Will, may be either written or nuncupative. See *Inſtitute of Imp. or Civil-Law.*

COECUM *Inteſtinum*, the Blind Gut, is the 4th in Order for the Stomach, and the firſt of the *Inteſtina Craſſa*, or Thick Guts. In Children new-born, and in Quadrupeds, 'tis found full of Excrements; but in adult and ſound Perſons, its Cavity often diſappears, and it only hangs like a Worm; and 'tis in ſuch about the Bigneſs, and Half the Length of a large Earth-worm; its Mouth, which opens into the Colon, is pretty large: It takes its Original rather from the Colon than the Ilium, to the former of which it ſeems to be a kind of Appendage. It is larger in Children than in Men; 'tis not tied to the Meſentery at all, but being placed in the Cavity of the *Os Ilium* by its End, it is joined to the Right-Kidney, the *Peritonæum* coming between. In Apes it is pretty large, but larger in Dogs; and in Conies, Squirrels, and Rats, largeſt of all, in Proportion to the Bulk of their Bodies: Its Uſe in Adult Perſons is very much undiſcovered, but in the *Fœtus*, or an Infant newly born, in which 'tis found full of Excrement, it ſeems to be a kind of Receptacle for the *Fœces* of the Inteſtines before the Birth, or during the time that the *Fœtus* doth not exonerate *per Alvum*. Dr. *Gliſſon* thinks alſo that it ſerves in ſuch Animals as have it at large, for a kind of ſecond Ventricle or Bag, wherein the prepared Aliments may be ſo ſtored up, and ſo long retained, till a richer, thicker, and more nutritious Juice may be drawn from them. Others ſay, it contains a Ferment; and others, the Flatuoſity of the Inteſtines; and others, that it ſeparates a Liquor by ſome Glands which are in its Cavity, which Liquor ſerves to harden the Excrements as they paſs thro' the *Colon*.

CO-EFFICIENT *of any generating Term* [in *Fluxions*] is the Quantity which ariſes by dividing that Term by the generated Quantity.

CO-EFFICIENTS [in *Algebra*] are ſuch Numbers as are prefixed before any Letters, or Species, into which Letters they are ſuppoſed to be multiplied; and therefore, with ſuch Letters, or with the Quantities repreſented by them, do make a Rectangle or Product (*conficiunt productum*) whence they take their Name. Thus *C b* implies, that the Quantity repreſented by *a b* is multiplied into the Co-efficient *C*, and that out of theſe two the Rectangle or Product *C b* is formed. If a Letter have no Number prefixed, 'tis always ſuppoſed to have to its *Co-efficient* 1, becauſe every thing is once itſelf.

The *Co-efficient* in a Quadratick Equation, is according to its Sign, either the Sum or Difference of the two Roots: And in any Equation of an higher Nature, the *Co-efficient* of the ſecond Term is always the *Aggregate of all the Roots*, retaining their proper Signs; ſo that if all the Negatives be equal to all the Affirmatives, the ſecond Term will vaniſh; and where the ſecond Term is thus wanting, 'tis a Sign that the Quantities under contrary Signs were thus equal.

The *Co-efficient* of the third Term is as the *Aggregate of all the Rectangles*, ariſing by the Multiplication of every two of the Roots, how many ways ſoever thoſe Combinations of Two's can be had, as three times in a Cubick, ſix in a Biquadratick Equation, *&c.*

The *Co-efficient* of the fourth Term is the *Aggregate of all the Solids* made by the continual Multiplication of every three of the Roots, how often ſoever ſuch a Tenary can be had, as there can four be had in a Biquadratick, ten in an Equation of five Dimenſions, *&c.* And thus it will go on infinitely, *&c.*

COELIA Κολία τὸ κοῖλον, [in an *Anatomical* Senſe] ſignifies any kind of Organical Cavity in an Animal Body; and hence Diſeaſes ſeated in the Venters or Cavities of the Body, are ſometimes called *Cœliack Affections*. See *Cœliack*.

COELIACK *Artery*, that which ariſes from the Trunk of the great Artery after it enters the *Abdomen*, and ſpreads into two Branches; the firſt (on the Right-hand) is the *Gaſtrica Dextra*, which goes to the Stomach, the *Ciſtica* to the Gall-Bladder, the *Epiplois Dextra* to the *Omentum*, the *Inteſtinalis* to the *Inteſtinum Duodenum*, and to a Part of the *Jejunum*, the *Gaſtro Epiplois* to the Stomach, to the *Omentum*, and ſome Branches to the Liver, which enter the *Capſula Communis*, to accompany the Branches of the *Porta*.

The Left Branch of the *Cœliack Artery* (which is called by ſome *Splenica*, becauſe it goes toward the Spleen) on its Upper-ſide ſends forth the *Gaſtrica Major*; which dividing into two Parts, after it hath ſent a little Twig to the Stomach, makes the *Coronaria Stomachica* and the *Gaſtrica Siniſtra*; and out of its loweſt Side ſpring the *Epiplois Poſtica*, which runs to the hinder Leaf of the *Omentum* and the *Colon* annexed to it; and the *Epiplois Siniſtra*, which goes to the loweſt and Left-ſide of the *Omentum*.

COELIACK *Paſſion*, or *Affection*, is a kind of Flux or *Diarrhœa*, wherein the Aliments either wholly changed, or only in Part, paſs by Stool, without any Chilification, and it is two-fold; the firſt, in which the Meat is only digeſted in the Stomach; the other, when Concoction or Fermentation is performed in the Stomach and Inteſtines both at once; but, by reaſon that the Lacteal Veſſels, or little Seats of the Guts, are obliterated thro' long Faſting, a purulent Dyſentery, or the like, the Chyle is not diſtributed. *Blanchard.* 'Tis called alſo *Lienteria*.

COELOMA is a hollow and round Ulcer in the Horny Tunick of the Eye.

COELUM is the Cavity of the Eye towards the the Corners. The Palate is alſo called *Cœlum* by ſome. *L. Blanchard.*

COFFER is a long ſquare Box of the firmeſt Timber, about 3 Foot long, and 1½ broad, wherein Tin-Ore is broken to Pieces in a Stamping-mill. See *Tin*.

COFFER [in *Fortification*] is a hollow Lodgment athwart a dry Moat, from ſix to ſeven Foot deep, and from ſixteen to eighteen broad, the upper Part being made of Pieces of Timber raiſed two Foot above the Level of that Moat; which little Elevation hath Hurdles laden with Earth for its Covering, and ſerves as a Parapet with Embraſures. The Beſieged generally make uſe of theſe Coffers to repulſe the Beſiegers when they endeavour to paſs the Ditch, and they are diſtinguiſhed only by their Length from the Caponniers, which are likewiſe ſomewhat leſs in Breadth; and it differs from the Traverſe and Gallery, in that theſe are made by the Beſiegers, and the Coffer by the Beſieged.

To ſave themſelves from the Fire of theſe Coffers, the Beſiegers epaule or throw up the Earth on that Side towards the Coffer.

COFFERER, of the King or Queen's Houſhold, is a principal Officer in that Court, next under the Comptroller; that in the Counting-houſe, and elſewhere, at other times, hath a ſpecial Charge and Overſight of other Officers of the Houſe for their good Demeanor and Charge in their Offices, to all which he pays their Wages, *vid.* 39 *Eliz.* c. 7.

COFFRE is alſo ſometimes uſed for *Caiſſons*, which ſee.

COGITATION properly is the Action of Thinking; but the *Carteſians* underſtand by it whatever we experience in ourſelves, and whereof we are conſcious, as all the Operations of our Underſtanding, Will, Imagination, and Senſes.

COGNATION. See *Agnation*.

COGNATIONE. See *Coſenage*.

COGNIZANCE [in *Heraldry*] is the ſame with the *Creſt*, which in any Atchievement helps to adorn and marſhal a Coat of Arms:

Alſo a Badge on a Serving-man, or Waterman's Sleeve.

In the Law, 'tis the Acknowledgment of a Fine, or Confeſſion of a thing done; as alſo a Power or Juriſdiction. Thus *Cognizance of Pleas* is an Ability to call a Cauſe or Plea out of another Court; which no one can do but the King, unleſs he can ſhew a particular Charter for it

COGNISEE, or *Connuſee*, is he to whom the Fine is acknowledged.

COGNISOR, or *Connuſor*, is he that paſſeth or acknowledgeth a Fine of Lands and Tenements to another.

COGNITIONIBUS *Mittendis* is a Writ to a Juſtice or other that hath Power to take a Fine, who, having taken Acknowledgment thereof, deferreth to certify it into the Court of *Common-Pleas*, commanding him to certify it. *L.*

COGRITAL *Line.* See *Line.*

COHÆSION *of the Parts of Matter* is that Quality (from whence ſoever ariſing) by which the Parts of all ſolid Bodies ſtick or adhere to one another. Some will have this to be effected by a certain Glue or Cement; others, by the Particles being hooked and branchy, and ſo to catch hold of one another; others will have it to be occaſioned by an imaginary Funiculus, or inviſible Rope or String, which holds the Parts together; others, by bare Reſt only: All which the famous *James Bernouli*, in his Book *De Gravitate Ætheris*, endeavours to refute, and thinks 'tis occaſioned by the Preſſure of the incumbent Air or Æther, and near the Earth of the whole Atmoſphere. This ſeems to be confirmed by the known Experiment of the Cohæſion of two well poliſed Marbles together, which yet will eaſily and ſpeedily fall aſunder, when put into the exhauſted Receiver, where the external Preſſure of the Air is taken off; and *Bernouli* ſuppoſes the whole Body of the Æther, as well as of the lower Air, to gravitate continually upon the Earth, and by that means to keep all its Parts together.

Sir *Iſaac Newton*, at the End of the *Latin* Edition of his admirable *Opticks*, concludes, from the Coherence of the Parts of hard and ſolid Bodies, that their Particles do attract one another by a certain Force, which acts moſt intenſely, when the Particles touch one another. At ſome little Diſtance it produces thoſe Chymical Effects or Operations which you will find an Account of under the Word *Attraction*, and which do not extend to remoter Diſtances, as far at leaſt as Senſe can determine; and indeed 'tis hardly poſſible to account for the Firmneſs and Solidity of many Bodies, which have either a vaſt Number of Pores or Meatus in them, and conſequently whoſe Particles cannot touch one another with their whole Surfaces, without ſuppoſeing that thoſe Particles be either ſtrongly compreſt together, or do ſtrongly attract one another. But it doth not ſeem reaſonable to attribute this Cohæſion of the Parts of Matter to any Preſſure of the Æther, as ſome have imagined; becauſe there is no certain Experiment of the Exiſtence of any ſuch thing as their Æther, nor (if there were) would it be effectual to ſolve this Phænomenon, any more than it is for many others, which they account for only by this means. But this mutual Attraction of the Particles of Matter within ſuch very narrow Bounds and Limits, which ſeem to be as much the Law of Nature, as Gravity, *&c.* will fairly account for this hitherto inexplicable Phænomenon. Dr. *Cheyne* takes into Conſideration the Plainneſs of the Surfaces of the cohering Parts of Matter, in order to account for this Property; which indeed ſeems a neceſſary Requiſite. He thinks we may ſuppoſe ſome of the primary Atoms of Matter, of which Bodies are conſtituted, to be terminated with plain Surfaces on all Sides; and ſuch produce Bodies of the ſtricteſt and firmeſt Cohæſion: Others may be terminated partly with Curve, as well as partly with Plain Surfaces; and theſe combined may produce Bodies of a middle Degree of Cohæſion; and ſuch as have Surfaces entirely Curve, may produce Fluids, *&c.* But this will not do alone; for tho' it will bring Bodies to immediate Contact, it will not keep them there, nor hinder them from being ſeparated by any Force, how ſmall ſoever: And the Fluids which ſurround our Globe, as the Particles of Light and Air, will get in between the Surfaces of Bodies when they are at any Diſtance greater than the Diameters of the conſtituent Particles of thoſe Fluids, and ſo by their lateral Preſſure will deſtroy the Efficacy of that attractive Force by which Bodies cohere: For ſince Light and Bodies act mutually one upon another, and that the Particles of Air endeavour to recede one from another (ſee *Air* and *Light*) they will render that Part of the Attraction whereby Bodies cohere, altogether inſenſible at any Diſtance greater than the Length of the Diameters of the Particles of theſe Fluids; ſo that the Force, by which Bodies cohere, cannot act but at very ſmall Diſtances, and certainly is much greater in immediate Contact than at any Diſtance how ſmall ſoever.

COHOBATE is a Term [in *Chymiſtry*] implying a repeating the Diſtillation of the ſame Liquor, having poured it again on the Matter which remains in the Veſſel. This Operation is uſed to open Bodies, or to violate the Spirits, and is called *Cohobation.*

COIL. See *Quoil.*

COINDICATIONS are Signs which do not indicate by themſelves alone, but together with other things, Circumſtances, *&c.* help the Phyſician to form a Judgment.

COINS, or *Quoins*, belonging to a Great Gun, are thoſe Wedge-like Pieces of Wood which ſerve to raiſe or lower her Breech on Occaſion.

There are alſo a ſort of *Coins* called *Canting Coins*, which are ſhort, and having three Edges, they are uſed in a Ship to put between Casks, and to keep them from rolling one againſt another in the Hold.

For the ſame Uſe almoſt ſerve a third ſort of *Coins*, called *Standing-Coins*, which are made of Barrel Boards, and are about four Inches broad, and of a fit Length to be driven in between the Ends of the Casks, about two or three Hoops from the Chine-hoops, to keep the Butts from jogging.

COINS [in *Architecture*] are a kind of Die cut *Diagonal* ways, after the manner of the Flight of a Stair-caſe, ſerving at Bottom to ſupport Columns on a Level, and at the Top to correct the Inclination of the Entablature, ſupporting a Vault.

Theſe *Coins* have alſo the ſame Effect as round Balluſters, which are not inclined according to any Flight.

COINS. I thought it would be very uſeful to give the Reader a Table of the Ancient and Modern Coins uſed in moſt Countries, which, as I had Opportunity, I collected, and are as follow:

I *The* Hebrew *or* Jewiſh Coins, *their Weight and Value, according to Dr.* Cumberland.

Value.

Shekel was $\frac{1}{2}$ Oz. Averdupois, 2*s.* 4*d.* 1*q.* $\frac{1}{8}$.

Bakah was $\frac{1}{2}$ a *Shekel.*

Zuzah was $\frac{1}{4}$ *Shekel.* This is mentioned by the *Talmudiſts.*

Gerah, *Agurah*, or *Keſhitah*, is the $\frac{1}{20}$ of a *Shekel.*

Talent was, in Weight, 3000 *Shekels.*

Valued, if { Silver, 353*l.* 11*s.* 10$\frac{1}{2}$*d.*
Gold, 5064*l.* 3*s.* 10*d.*

Manah, in Weight, 100 *Shekels*, Value 60 *Shekels.*

The *Perſian Darchmons*, or *Golden Daries*, are equal to 12 *Gerahs.*

The *Roman Silver Denarius* was 7$\frac{3}{4}$ *d.*

The *Roman Gold Denarius* was double in Weight.

The *Roman Brazen Aſs* weighed $\frac{1}{2}$ an Ounce, Value 3$\frac{1}{10}$ *Farthings.*

The *Aſſarium* was $\frac{1}{2}$ of the *Aſs.*

Quadrans $\frac{1}{4}$ Part.

The *Mitre* was $\frac{1}{8}$ of the *Aſs*, or about $\frac{1}{2}$ of our *Farthing*.

Seſtertius (mark'd thus, IIS) was 2 *Aſſes* and an Half, in Value 7 *Farthings* and $1\frac{3}{6}$ of a *Farthing*.

Denarius (mark'd thus, X) was ten times the *Aſs*, and therefore was, of our Money, 7 *Pence* three *Farthings*.

Seſtertium was 8 *l.* 1 *s.* 5 *d.* 2 *f.*

An Account of the Hebrew Coins, *from Mr.* Jeak's *Arithmetick.*

					l.	*s.*	*d.*
Hebrew	Money	Silver	(*a*) *Shekel of the Sanctuary*, in	Weight $\frac{1}{2}$ *Oz.* Troy Value to *Sterl.* Money	0	2	6
			(*b*) *King's Shekel*, $\frac{1}{2}$ the *Sanctuary Shekel*, called *Bekah*		0	1	3
			(*c*) Third Part of the *Shekel*	—— ——	0	1	3
			(*d*) *Zuz*, Fourth Part of the *Shekel*	— —	0	0	10
			(*e*) *Gerah*, *Agurah*, *Keſhitah*	—— ——	0	0	$7\frac{1}{2}$
		Gold	(*f*) *Zahab*, *Golden Siculus*, or *Shekel*,	each $\frac{1}{2}$ *Oz.* Troy, in Value 12 *Silver Shekels of the Sanctuary*	1	10	$0\frac{1}{2}$
			(*g*) *Adarkon*, *Dracmon*, or *Darcon*,	each Half ſo much — —	0	15	0
	Sums of Money		(*h*) *Maneh*, or *Mina*, or a *Pound*, valuable in	Gold, 100 *Shekels*, 25 *Oz.* Troy — —	75	0	0
				Silver, 60 *Shekels*, 30 *Oz.* Troy — —	7	10	0
			(*i*) *Chichar* or *Talent* in Weight	3000 *Shekels* 123 *lb.* Troy valuable in Gold, 4500	0	0	0
				Silver, 375	0	0	0

(*a*) This Piece of *Coin* is often mentioned in Sacred Writ, and looks like the Standard of all the reſt. On the one Side was ſhewed the Veſſel in which the *Manna* was inſcribed in this Perigraph, *Shekel Iſrael*; on the other Side, the *Rod* of *Aaron* that budded, with this Inſcription, *Jeruſalem Kodſhaſh*, in *Engliſh*, *The Holy Jeruſalem*, called *Shekel* from *Shakal*, to weigh; for Money, at the firſt, ſeems to be a Merchandiſe, exchanged or given for other Commodities, as (*Gen.* 23. 16.) after the *Chaldee* called *Silgha*, and commonly with the *Hebrews*, *Keſeph*, i. e. *Silver*; and being put abſolutely, rendered a *Silverling* or Piece of Silver, by Expoſitors, as uſually as a *Shekel*, when the Quality is not mentioned, is taken for a *Silver Shekel*.

(*b*) Firſt mentioned, *Gen.* 24. 22. paid by all as yearly Tribute, *Exodus* 30. 13, 15. 2 *Chron.* 24. 6, 9. towards the Repair of the Tabernacle firſt, and after of the Temple. Between this and the *Sanctuary Shekel* ſome mentioned a third ſort of *Shekel*, called the *Common Shekel*, valued at 20 *d.* of our Money, of which I find nothing but Uncertainty.

(*c*) In *Nehem.* 10. 32. noted as a Yearly Tribute given to the *Jews* by a Civil Decree to the Second Temple.

(*d*) 1 *Sam.* 9. 8. ſpoken of, and equal to the old *Attick Dram* and *Roman Penny*, as ſeveral ſay, and by ſome called *Zuz*, *Zuza*, *Zur*, and *Zura*.

(*e*) *Agurah*, rendered *Gerah* by the *Chaldee* Paraphraſe, and alſo *Megna* or *Megha* in that Tongue; by the *Arabians*, *Mega*; *Greeks*, *Obolus*; and in *Engliſh*, a *Piece of Silver*, 1 Sam. 2. 36. called alſo in the *Hebrew*, *Keſhitah*, becauſe ſigned with the Image of a Lamb, ſee *Gen.* 33. 19. *Joſh.* 24. 32. Twenty of theſe make a *Shekel*, Exod. 30. 13.

(*f*) The *Zahab* and *Golden Shekel* in *Rider's Dictionary* undervalued at 15 *s.* For tho' *Aunt* in his *Handmaid to Arithmetick* out of *Brerewood de Nummis*, mentioneth the Weight but two *Attick Drams*, yet he valueth it at 30 Shillings. *Alſted* in his *Encyclopædia* of *Arithmetick* makes it four Drams, which accounted $\frac{1}{2}$ Ounce *Troy*, muſt yield double the Value of 15 *s.* And moſt Authors agree, that the *Gold Shekel* was equal in Weight with the *Silver Shekel*; ſo the Difference muſt be only in the Value of the Metal. Some, to keep up the Credit of differing Authors, conceive there were two ſorts of *Golden Shekels* as well as *Silver*, the one double to the other.

(*g*) Theſe Golden *Adarkons* and *Drachmons*, ſeem to be *Perſian*, or Coins of ſome other *Nations*, and current, not coined in *Judea*, nor read of till after the *Captivity*; for tho' the Word be uſed 1 *Chron.* 29. 7. yet both Books of the *Chronicles*, as moſt take it, were penn'd by *Ezra* after his Return from *Babylon*, in whoſe Book Mention is made thereof, as in *Ezra* 2. 69. and 8. 27, *&c.* in *Greek* called *Drachme*, and in *Engliſh* rendered *Drams*. *Alſted*, in his *Encyclopædia* of *Arithmetick*, makes the Value equal to a *Ducat* of *Hungary*. But *Hunt*, who throughout his Book, hath much loſt himſelf in valuing two *Attick Drams*, in the *Zahab*, at 30 *s.* and two *Attick Drams*, in the *Adarkon* (which he ſaith is the Weight thereof) at 15 *s.*

(*h*) The *Maneh* in Gold, by comparing 1 *Kings* 10. 17. with 2 *Chron.* 9. 16. is found to be 100 *Shekels*, which *Buxtorf* and others underſtand not of the *Holy* but the *Royal Shekel*. The *Maneh*, in *Ezek.* 45. 12. ſeems to be 60 *Shekels*, and hereto ſeveral agree, but ſome think it was now encreaſed 19 *Shekels* more than of old, and call it the *New Maneh*, valued nevertheleſs with moſt after the *Holy Shekel* (in Silver) at 7 *l.* 10 *s.* *Buxtorf* tells us alſo of a *Maneh* of 25 *Holy Shekels*. The *Aſſembly's Annotations* on *Ezek.* 45. 12. make three ſorts of *Manehs*, viz. *Common* 15, the *King's* 20, and the *Holy*, 25 *Shekels*; but the Word *Maneh* is ſingular, and not plural, in the *Hebrew* Text there, as noting all thoſe Diviſions to make but one *Maneh*.

(*i*) The *Chichar*, by ſome wrote *Kichar*, and commonly tranſlated *Talent*, contained 3000 *Shekels*, as may be collected from *Exodus* 38. 25,26. where the Silver collected is expreſſed to be 100 *Talents*, and 1775 *Shekels*, *v. g.* and the Perſons that paid it at Half a Shekel a Piece, *v.* 26. numbred to be 603550, whereof the Half is 301775; which divided by 3000, the Shekels in one Talent makes 100 Talents, and leaves the odd Shekels remaining, 30)1775(100

3 000

The Talent thus valued after the Holy Shekels, makes the Number of Talents mentioned in ſome Texts of Scripture, eſpecially 1 *Chron.* 22 and 29 Chapters, amount to ſuch maſſy Sums, that ſome think the Talents are to be reckoned at the Rate of the other Shekel; and others, not improbably, that the *Jews* had a Piece of Money or Plate of Gold of ſmall Value (as may be obſerved anciently in *Homer. Iliad.* Lib. 23.) called a *Talent.* And *Fuller,* in his *Piſgah Sight of* Paleſtine, *Book* 3. *p.* 356, 357, ſhews whereon ſuch an Opinion may be ſtrengthened; and that the Talent mentioned in ſome Scriptures may be rather this than the other.

The Account both of the Hebrew Weight *and* Money, *with their Value in* Sterling Money *and* Troy Weight, *is contracted into the following Table.*

Hebrew Gold *and* Weights.

Chichar or *Talent*	1	*Maneh.*		
Maneh or *Pound*	*Old New* 60 50	1 *New Old*	*Zahab.*	
Zahab or *Shekel*	3000	60 50	1	*Adark.*
Adarkon or *Dram*	6000	120 100	2	1
Troy Weight	125 *l.*	2½ *l.* 1*l.* 1℥	½ *Oz.*	¼ *Oz.*
Sterling Money	4500	90 *l.* 75 *l.*	1*l.* 10*s.*	15 *s.*

Hebrew Silver *and* Weights.

Chichar or *Talent*	1	*Maneh.*					
Maneh or *Pound*	*Old New* 60 50	1 *New Old*	*Shekel.*				
Shekel	3000	60 50	1	*Bekah.*			
Bekah	6000	120 100	2	1	*Third Part.*		
Third Parts	9000	180 150	3	1½	1	*Zuz.*	
Fourth Parts, Zuzims or *Drams*	12000	240 200	4	2	1½	1	*Gerah.*
Gerabs	60000	1200 1000	20	10	6⅔	5	1
Troy Weight	125 *l.*	2½ *l.* 2*l.* 1℥	½*Oz.*	¼*Oz.*	⅙*Oz.*	⅛*Oz.*	$\frac{1}{40}$ *Oz.*
Sterling Money	375 *l.*	*l. s. l. s.* 7 10 6 5	*s. d.* 2 6	*s. d.* 1 3	*d.* 7½	*d.* 7½	*d.* 1½

The *Roman Libra,* called alſo *As,* and by Tranſlators commonly rendred *a Pound,* was divided into 12 *Ounces,* and for every Number of *Ounces* under 12, a proper Name uſed; as,

	Oz.
Deunx — — —	11
Dexians and *Decunx* — —	10
Dodrans — — —	9
* * *Bes, Beſſis,* and of Old, *Des* —	8
Septunx — — —	7
Semis, Semiſſis, Semiſſius, Selibra, and *Simbella*	6
Quincunx — — —	5
Triens — — —	4
Quadrans, and *Triunx* — —	3
Sextans — — —	2
Uncia — — — —	1

Malines, P. 24. of his *Lex Mercatoria,* divides *Pounds,* which he calls the *Old Pound* of the *Romans,* into

64	*Dinarios.*
128	*Quinareos.*
256	*Seſtertios.*
640	*Aſſes.*
1280	*Semilibella's.*
2560	*Teruncios.*

A Reaſon is wanting, why *Legat* makes the *Roman Libra* of 12 Oz. but 10½ Oz. *Troy;* ſince, if he reckon by the Number of Grains (the Original of Weights) at 5760 Grains of Aſſize in the Pound *Troy;* it can be but 10 Oz. juſt; for 10 times 6912, the Grains in a *Roman* Pound, and 12 times 5760 are equal; but if he count the Pound *Troy* at 7580 Grains, according to the Statute at 32 Grains of Wheat to a Penny-Weight, the *Troy Pound* will be 13⅓ Oz. *Roman.*

* * *Bes*, is the Mark-Weight, Two-thirds of the Pound, *Malines*, P. 24. aforeſaid, makes the *Bes* or Old-Mark of the *Romans* to be divided into

16	*Loos*, or *Tetradrams.*
$23\frac{1}{3}$	*Tridrams.*
32	*Didrams.*
64	*Drams.*
96	*Obolos*, or *Treobolas.*
128	*Triobulos.*
384	*Obolos.*
768	*Miobolos.*
3840	*Moments.*

b. Semiuncia, or the Half-Ounce, is ſometimes called *Aſſarion* and *Aſſarius* ; and by *Alſted*, *Lotho*, anſwering to a *German* Weight of that Name.

c. Duella, being double the Weight of the *Sextula*, is ſometimes called *Binæ Sextulæ.*

d. Sicilicum, or *Silicus*, and, by Abbreviation, *Siclus*, is One-fourth of an Ounce.

e. Sextula, uſed promiſcuouſly with *Sextans*, and underſtood, by Import of the Name, to be the Sixth-part.

f. Denarius, a Penny-weight, the Seventh Part of the Ounce, whether uſed to weigh any thing but Money as the other Diviſions thereof, ſomewhat queſtionable, ſee among the Money. *Alſted* compares the *Drachmal Denarius* to the *German* Weight *Quintlein.*

g. Quinar, was Half the Penny-weight, and a Piece of Money ſet afterward among the *Roman* Coins.

* Between the *Quinar* and *Scruple* ſome mention a Weight called *Termiſſis*, containing 32 Grains, being the Eighteenth-part of an Ounce.

h. Quadrans, here is $\frac{1}{4}$ of the Penny-weight; and ſo called *Quadrans Denarii*, to diſtinguiſh it from *Quadrans Libræ*, which was 3 Ounces.

i. Sextans, called *Sextans Denarii*, to difference it from *Sextans Libræ*, was the Sixth-part of the Penny-weight, and ſometimes called *Sextula.*

k. Obolus, or Half a Scruple, called ſometimes *Simplium*, weigheth 12 Grains. If there be another *Obolus*, as ſome ſay, which was the Third-part of a *Quinar*, it ſeems to be a Piece of Coin, and muſt weigh $13\frac{1}{3}$ Grains, and ſo is all one with the *Sextans*, according to the *Tabulary* Diviſions; yet this ſort of *Obolus* they make to contain but 10 Grains.

Between the *Obolus* and the *Siliqua*, ſome mention a *Cerates*, which they ſay contains Six Grains, and ſo is half the *Obolus*, or One-fourth of the *Scruple.*

Roman *Monies, and their* Engliſh *Values.*

					l.	s.	d.
Roman	*Money before the Tranſlation of the Imperial Seat to* Bizantium,	Braſs	*Leſs than the* As.	Sextula, $\frac{1}{6}$ Unciæ	0	0	$0\frac{1}{96}$
				Semiuncia, $\frac{1}{2}$ Unciæ	0	0	$0\frac{1}{32}$
				Uncia, $\frac{1}{12}$ Aſſis	0	0	$0\frac{1}{16}$
				Sextans, $\frac{1}{6}$ Aſſis	0	0	$0\frac{1}{8}$
				Quadrans Triunx Teruntius $\frac{1}{4}$ Aſſis	0	0	$0\frac{3}{16}$
				Triens, $\frac{1}{3}$ Aſſis	0	0	$0\frac{1}{4}$
				Semiſſis, $\frac{1}{2}$ Aſſis	0	0	$0\frac{3}{8}$
			As *or* Libra	Half Denarii	0	0	$0\frac{3}{4}$
			Greater than the As.	Decuſſis, 10 Aſſes	0	0	$7\frac{1}{2}$
				Viceſſis, 20	0	1	3
				Triceſſis, 30	0	1	$10\frac{1}{2}$
				Quadraceſſis, 40	0	2	6
				Quinquaceſſis, 50	0	3	$1\frac{1}{2}$
				Sexaceſſis, 60	0	3	9
				Septuaceſſis, 70	0	4	$4\frac{1}{4}$
				Octaceſſis, 80	0	5	0
				Nonaceſſis, 90	0	5	$7\frac{1}{2}$
				Centuſſis, 100	0	0	3
		Silver	Nummi, *or* Nummuli.	Teruntius, $\frac{1}{40}$ Denarii	0	0	$0\frac{3}{16}$
				Sembella, $\frac{1}{2}$ Libellæ	0	0	$0\frac{3}{8}$
				Libella, $\frac{1}{10}$ Denarii	0	0	$0\frac{3}{4}$
				Obolus, $\frac{1}{6}$ Denarii	0	0	$1\frac{1}{4}$
				Seſtertius, $2\frac{1}{2}$ Aſſes	0	0	$1\frac{7}{8}$
				Victoriatus Quinarius $\frac{1}{2}$ Denarii	0	0	$3\frac{3}{4}$
				Bigatus	0	0	$7\frac{1}{2}$
				New Denarius, 10 Aſſes, $\frac{1}{8}$ *Oz.*	0	0	$7\frac{1}{2}$
				Old Denarius, $\frac{1}{7}$ *Oz.*	0	0	$8\frac{4}{7}$
		Gold		Tremiſſis, *or* Golden Triens	0	5	0
				Semiſſis, *or* Golden Drachmal	0	7	6
				Imperatorius	0	15	0
				Amient, *or* Conſularis	0	15	0
	Money after the Tranſlation of the Imperial Seat to Bizantium,	Braſs		Follis	0	0	$0\frac{5}{12}$
		Silver		Siliqua, *or* Ceratium Simple	0	0	5
				Siliqua, *or* Ceratium Magnum	0	0	$7\frac{1}{2}$
				Milliaraſium	0	1	3
		Gold		Conſtantine's Piece	0	8	$6\frac{6}{9}$
				Valentinian's Piece	0	10	0
				Semiſſis, *or* Half-Piece	0	5	0
				Triens, *or* One-third of that Piece	0	3	4
				Scruple, *or* One-fourth of that Piece	0	2	6
	Roman *Sums of Money*			Quadrantes. Seſtertios.			
				Sportula, containing 100, or 10	0	1	$6\frac{3}{4}$
				Libra, a Pound of 96 Drams	3	0	0
				Seſtertium (in the *Neuter Gender*) containing 1000 Seſtertio's (in the *Maſculine Gender*)	7	16	3
				Talent, containing 24 Seſtertio's, or 6000 Denario's	178	10	0

The Braſs *Unica*, miſprinted in *Rider*, at $1\frac{1}{0}$ *Aſſis*; for $1\frac{1}{0}$ Part of 3 Farthings cannot be $1\frac{1}{6}$ of our Penny, counting 4 *Cees* to a Farthing, as they do.

So alſo is *As*, as *ob. q.* for *ob. qa*; for *As* being the 10th Part of the *Dennarius*, muſt be three Farthings, 10 times 3 making 30 Farthings, which is $7\frac{1}{2}$ *d.* the Value of the *Denarius*. To the Braſs *As* was the Silver *Libella* equal in Value.

Obolus, being $\frac{1}{6}$ of the *Roman* Penny, is called by *Celſus*, *Sextans*.

Seſtertius, Engliſh'd, a *Seſtertian*, was $\frac{1}{4}$ of the *Roman* Penny, and being of the *Maſculine Gender*, was differenced from the other being of the *Neuter Gender*,

Gender, and in numbering by theſe *Seſtertias's*, theſe Three Rules are to be obſerved.

1. If the Numeral Noun agree in *Caſe*, *Gender*, and *Number*, with the *Seſtertian*, it ſignifieth barely juſt ſo much as was pronounced, as *Decem Seſtertii* is 10 *Seſtertians.*

2. If the Numeral Noun of another *Caſe* be joined with the *Genitive Caſe Plural* of *Seſtertius*, it noteth ſo many Thouſands, as *Decem Seſtertium* (for *Seſtertiorum*) is 10000 *Seſtertians.*

3. If an *Adverb* be put without any Numeral joined, as *Decies*, *Vigeſies*, *&c.* or joined with *Seſtertium* the *Genitive Caſe Plural*, there is underſtood by it ſo many Hundred Thouſand, as *Decies Seſtertium* is Ten Hundred Thouſand *Seſtertians.* *Alſted* delivers it thus :

From 1 *Seſtertian* to 1000 in the *Maſculine Gender*, as *Unus Seſtertius*, *Decem Seſtertii*, *&c.* is one Seſtertian, 10 Seſtertians, *&c.*

From 1000 to 100000 in the *Neuter Gender* and *Plural Number*, as *Singula Siſtertia* 1000 Seſtertians, *Bina Seſtertia*, 20 Seſtertians, *&c.*

From 100000 upward, all expreſſed adverbially and in the *Genitive Plural*, as *Semel Seſtertium* 10000, *Decies Seſtertium* 1000000, *&c.*

Victoriatus was ſo called, becauſe ſtamped with the Image of Victory; and *Quinarius*, becauſe equal in Value to 5 Braſs *Aſſes*, or $\frac{1}{2}$ the *Denarius.*

Bigatus, ſome call *Quadratus*, had the Print of a *Cart* or *Chariot* on it, and was of Value equal with *Denarius.*

Denarius, q. d. *Dena æris*, becauſe it containeth 10 *Aſſes*, rendered a Penny. *Mat.* 18. 28. and 22. 19. at the Old Rate, was $\frac{1}{7}$ of an Ounce, and at the New, $\frac{1}{8}$; and at this Rate all the other Coins are valued in the Table. This is ſometimes called the *Drachmal Denary* for Diſtinction ſake. Some make 3 ſorts of Pence; the heavier weigheth $1\frac{1}{2}$ *Attick Dram* ; the mean, of one *Dram*, and the leaſt, lighter than 1 *Dram* by $\frac{1}{64}$ of an Oz. or thereabouts. Some ſay one was $\frac{1}{6}$ of the *Roman Uncia*, the mean $\frac{1}{7}$, and the lighter $\frac{1}{8}$. *Budeus* makes the *Attick* Dram and *Roman* Penny of the ſame Weight and Worth, wherewith moſt agree; and accordingly each, in the foregoing Tables, are valued at $7\frac{1}{2}$ *d.* after 5 Shillings the Ounce.

The *Golden Denarius* mentioned in *Holyoke*, at 2*s.* $4\frac{1}{2}$ *d. Sterling*, I have omitted, as not ſatisfied in the Weight, nor certain of ſuch a Coin.

The *Golden Amient* ſeems the eldeſt and greateſt, a Piece coin'd by the Conſuls, therefore called *Conſularis*, weighed $2\frac{1}{2}$ Drams.

The *Imperatorius*, or Piece of the Emperor's Coin, 2 Drams.

The *Drachmal*, 1 Dram, and the *Triens* of the *Imperatorius.*

After *Conſtantine* removed his Seat to *Bizantium*, now called *Conſtantinople*, a City after his own Name, we read of *Follis* in *Euſebius*, a Braſs Piece as *Lampridius*, or of *Iron*, as *Euſtathius* ſaith, ſo called becauſe it repreſenteth a Leaf, in *Latin*, *Folium*, and was $1\frac{1}{2}$ of the *Silver ſimple Siliqua.*

The *Silver Siliqua* or *Ceratium* was double. The Simple $\frac{1}{3}$ of the *Millieriſium* Value 5 *d.* The Great called *Cerates*, 1 Dram equal to the Penny $7\frac{1}{2}$ *d.*

Milliariſium, weighed 2 Drams.

Conſtantine's Piece of Gold was called *Romanus Solidus*, at the Rate of 7 *s.* 5 *d.* For a Dram of Gold muſt weigh $1\frac{1}{2}$ Dram.

Theſe continued currant till *Valentinian*, who made his Coin ſomewhat heavier.

Valentinian's Piece of Gold, by ſome, is called *Sextula*, and, being valued at 10 *s. Sterling*, muſt weigh $1\frac{1}{3}$ Dram.

Of which the	*Semiſſis*	being	$\frac{1}{2}$	was	$\frac{2}{3}$	of a Dram.
	Tremiſſis, or *Triens*		$\frac{1}{3}$		$\frac{4}{7}$	
	Scruple		$\frac{1}{4}$		$\frac{1}{3}$	

Sportula, ſay ſome, was a Lawyer's Fee, or an Alms diſtributed by Princes among the People. See *Selden's Hiſtory of the Tythes*, Chap. 4. P. 37, 38.

Accounts of Exchange of Money at ſeveral Places.

2. 11. ALEPPO, the Exchange is made by *Sultanies* of 120 *Aſpers*, or *Dollars* of 80 *Aſpers*, every *Aſper* 10 *Marcherines.*

3. 1. *Alexandria*, they account by *Ducats*, either *Ducat de Pargo* of 120 Maids, Ducat of *Venice* of 40 Maids, or *Italian* Ducat of 35 Maids.

1. 7. *Ancona*, Exchange is made on the Ducat of 21 Groſs (which is in Specie 23 Groſs) which Ducat alſo is 14 *Carlina*, and every *Carlina* 6 *Bollidini* ; ſo in the Ducat of 84 *Bollidini.*

1. 4. *Arragon*, the Rial or Ryal of the Plate is 23 *Dinero's* (*Hunt* ſaith 13.) and the Ducat is 12 Ryals, whereon they make Exchange; and they account by Pounds of 20 *s.* and 12 *d.* And the Ducat of 12 Ryals, every Ryal of 1 *s.* or 12 *d.*

1. 8. *Artois*, and in ſeveral other Places, they account and exchange by Pounds or Livres, *Tournois* of 20 Stivers, or 40 Pence *Flemiſh*, whereof 6, called *Guilders* or *Florins*, makes the Pound *Flemiſh* in all the 17 Provinces of the *Netherlands* ; which Pound is divided into 20 *s.* and every Shilling into 12 *d.* *&c.*

Some reckon by the Pound *Paris*, which is but 20 *d.* whereof 12 make 1 Pound *Flemiſh* ; but their Accounts, as alſo the Finances of the Princes, are kept by Pounds *Tournois*, and both Pounds divided in 20 *s.* and every Shilling into 12 *d.* admitting alſo the Sub-diviſions of Obolo's, Maille, Heller, Hallnick, Corte, Mites, Points, Engevin, Poot, and ſuch like Copper-Monies.

Alſted mentions the Florin in *Germany* to be 15 Batz, every Batz 2 Albes, every Albe 8 Oboli or Nummo's : So ſhall the Florin be 30 Albes, or 240 Oboli.

1. 4. *Auguſta*, or *Ausburgh*, Accounts on the Dollar coined at 65 Creutzers, riſen ſince to 72. Exchange is made on the imaginary Rate of 65 Creutzers.

A Creutzer is ſometimes called a *Schreikenbörger*, and in *Latin*, *Crucigerus* and *Cruciatus*, being Pieces ſtamped with a Croſs : Their Croſs make 12 Creutzers; their Lyon-Piece, Half a Creutzer. They have their Snubourgh, Blaphart, or Bohemico's of 3 and $3\frac{1}{3}$ Creutzers. The Rix or Rycks

Dollar is 30 Albes of 8 *d.* or 72 Creutzers every Dollar, as before. See the following Table, and afterwards in *Germany.*

	Groſs.	*Batz.*	*Albes.*	*Creutzers.*	*Lyon.*	*Pence.*	*Black-pennies*
Dollar.	6	18	30	72	144	240	288
		3	5	17	24	40	48
Batz.			1⅔	4	8	13⅓	16
Albes.				2⅖	4⅘	8	9⅗
Creutzers.					2	3⅓	4
Lyons.						1⅔	2
Penny.							1⅕

3. 2. *Barbary,* generally Accounts are kept, and Commodities ſold by Ducats of 10 Ounces, each Ounce divided into 8 Parts, which 8th Part is in Value 12 *d.* Sterling.

1. 14. *Barcelona,* as at *Arragon.*

1. 4. *Bavaria,* Accounts and Exchanges both are by Guilders of 7 *s.* and 30 *d.* to the Shilling.

1. 4. *Bohemia,* as in *Germany,* generally by the Dollar of 24 Bohemico's, called alſo *White Groſs,* each of 3 Creutzers: Other Diviſions ſee in the Table following.

	Marks.	*Dollars.*	*Angſters.*	*Bohemico's.*	*Creutzers.*	*Pence*
Scoc.	1½	2½	30	60	180	600
Mark.		1⅔	20	40	120	400
Dollar.			12	24	72	240
Angſter.				2	6	20
Bohemico.					3	10
Creutzer.						3⅓

1. 7. *Bolognia,* they account by Piaſtra or Pounds (called alſo Piaſtri) each containing 20 Bologneſi; and exchange on the Ducat of 4 Piaſtri.

1. 8. *Brabant,* and in moſt Places of the *Low Countries* Monies are accounted by the Pound *Flemiſh,* containing 20 *s.* *Flemiſh,* and every Shilling 12 *d.* or Deniers, called ſingle Stivers, two of which make one double Stiver. See *Flanders.*

1. 4. *Breſlaw,* they reckon by Marks of 32 Groſs of 12 Hellers to the Groſs; and exchange by 30 Florins, to have at *Norenborgh* 32 Florins, and at *Vienna* 34 Florins.

1. 7. *Calabria,* Exchanges are made by the *Naples* Ducat of 10 Carlini.

1. 14. *Caſtile,* Exchanges are made on the Ducat of 375 *Marvedies,* which they call in the Bill of Exchange *Ducadas d'oro,* or *de Peſo;* to be paid out of the Bank is better by 6 or 8 *pro Miliar.* See *Spain.*

1. 14. *Catalonia,* as at *Arragon.*

1. 4. *Cleves, Collen,* both Accounts and Exchanges are made by Dollars of 72 *Creutzers.*

	Marks.	*Morkens.*	*White Pennies.*	*Shillings, or Stivers.*
Their *Guilders* is	4	12	24	48
Mark.		3	6	12
Morken.			2	4
White Penny.				2

1. 5. *Conſtantinople,* as *Aleppo.*

1. 9. *Dantzick,* they account by *Poliſh* Guilders of 30 Groſs, every Groſs 18 *d.* They buy with the great Mark of 60 Groſs, or the little Mark of 15 Groſs; alſo by the Scoc. of 3 great Marks: And exchange upon the Florin *Poliſh,* or the Pound *Flemiſh.* They have Dollars of 35 Groſs of 3 Shillings, and new Dollars of 24, 26 or 30 Groſs. Their Gilden is 80 Groſs, ſo is

	Gildens.	*Great Marks.*	*Dollars.*	*Guilders.*	*Little Marks.*	*Groſs.*	*Pence.*
Scoc.	2¼	3	5⅐	6	12	180	3240
Gilden.		1⅔	2⅖	2⅔	5⅓	80	1440
Great Mark.			1⅘	2	4	60	1080
Dollar.				1⅙	2⅓	35	630
Guilder.					2	30	540
Little Marks.						15	270
Groſs.							18

1. 1. *Denmark*, they account by Marks of 20 Shillings, and exchange upon the Dollar.

1. 6. *Dublin*: See *Ireland.*

1. 12. *Edinburgh*: See *Scotland.*

1. 4. *Embden*, they reckon by Guilders, and exchange on the Rix-Dollar, but from *London* hither and thither upon the Pound Sterling.

1. 8. *Flanders*, as before in *Brabant*. See a more particular Diviſion of the *Flemiſh* Money in the following Table.

	Guilders.	*Shillings.*	*Double Stivers.*	*Single Stivers*	*Groats.*	*Ortgens.*	*Negen-Manneken.*	*Copper Pence.*	*Mites.*
Flemiſh Pound.	0	20	60	120	240	480	960	1920	2880
Guilder.		3⅓	10	2	40	80	160	320	480
Shilling.			3	6	12	24	48	96	144
Double Stiver.				2	4	8	16	32	48
Single Stiver.					2	4	8	16	24
Groat.						2	4	8	12
Ortagen or Ortken.							2	4	6
Negen-Manneken.								2	3
Copper Penny.									1½

Five ſingle Stivers are current in ſeveral Places of the *Low Countries* for ſix Pence Sterling; Ortkens in ſome Places are called Duyts; Mites in ſome Places of *Flanders* are called Cortes, Engcuni, Points, Pites, Poots.

1. 7. *Florence*, they account by Crowns 20*s.* 12*d.* to the Shilling; and exchange by a Ducat called *Largo*, or *Scripto in Banco*. A Florin there is 24 Quatrini

1. 3. *France*, generally they uſe Livres, Sols, and Deniers, and commonly account by them, as the *Engliſh* by Pounds, Shillings and Pence; but by an Edict made 1577, their Accounts are to be kept in *French* Crowns of 60 Sols to the Crown, or 3 Livres, that is, Pounds *Tournois*; and Exchange is made thereupon, unleſs for ſome Places in *Italy*, where they exchange for Number, to have ſo many Ducats for ſo many Crowns of the Sum, not *in ſpecie*, but imaginary, yet repeating the Value or Par. See further in the Table and Notes thereupon.

	Livres.	*Sols.*	*Liarts*	*Doubles.*	*Deniers.*
French Crown. A	3	60	240	360	720
Livre. B		20	8	120	240
Sols C			4	6	12
Liart. D				1½	3
Double. E					2

There are alſo Petit Deniers and Mailles, but not conſiderable. A. This Crown here to make exchange by, is equivalent to the Silver Coins of *Lewis* XIIIth and XIVth, called *Lewiſes*, and imaginary, and not to be accounted for the *French* Gold Crown, which is a real Coin, and of great Value now, being worth about 8*s.* Sterling. The Account and Exchange agreed in reality to 10 Sols then, and yet commonly reckoned for an *Engliſh* Shilling. Of this Gold Crown was the Cardecue a Quarter, and ſo valued in Sterling Money at 18*d.* and ſhould be wrote *Quartid Eſcue*, *Eſcue* being *French* for a Crown.

B and C, the Livres (or Pounds, ſometimes called Franks) and Sols (wrote ſometimes Soulx) derived from the *Latin Solidus*, as *Livre* from *Libra*, are different. Thoſe commonly uſed are called *Tournois*, and valued with Sterling Money as above. Of the Sols *Barrois* 14 make 20 Sols *Tournois.* The Sols *Mauſais* is 2 Sols *Tournois*: The Sols *Paris* is 1¼ Sols *Tournois*. The Sols *Bourdelois* is half the Sols *Paris*, and ſo accordingly is the Livre to be accounted.

D and E; neither the Liarts nor Doubles, though both Copper Coins are uſed in common Accounts.

1. 4. *Franckfort*, their Guilder or Florin by which they reckon is 60 Creutzers divided by 20*s.* and every Shilling in 12 Hellers according to the Pound. But they exchange by the Dollar of 65 Creutzers, payable in the two Yearly Fairs or Marts, one the Week before *Eaſter*, and the other all the Month of *September*.

1. 7. *Genoa*, all Accounts and Exchanges are made by Crowns of 60*s.* divided into 20*s.* and every Shilling into 12 Pence.

1. 4. *Germany*, every Batz, by which generally they keep Accounts, is 4 Creutzers: They exchange on the Dollar, imaginary at 65 Creutzers, and ſo coined, as was noted before at *Auguſta*, though riſen to 72 in Value.

They have Pieces of 3, 6, and 12 Creutzers, and by them and their Batz they value their own and *Exotick* Coins; as the *Hungarian* Ducat is 27 Batz; the Gold Guilder is 18 Batz; the *Poliſh* Guilder or Dollar is 15 Batz; Teſton 5 Batz, *&c.* A Guilder was the Name the ancient *Romans* gave to an Ounce, and 8 Ounces made a Mark, and 12 Ounces of Guilders a Pound; and there were coined Pieces called *Nummi Dragmi* or *Groſhen*, the 8th Part of a Dollar. *Anno* 1520 was the Gold Guilder coined for a general Coin, and valued in *Holland* at 28 Stivers, but now in Specie at double the Price: Nevertheleſs Corn brought from *Poland* and the *Eaſt Countries*, is bought and ſold by the ſame at the old Value of 28 Stivers.

Angelicies was the ſixth Part of a Dollar, making 3 Batz or 12 Creutzers. Theſe Angelici becoming Tribute Pennies were allayed, and ſo being made worſe, did obtain the Name of Batz or Bats (ſometimes wrote Batſes) *quaſi* Baſe: And in *Thuringia* they are called Gulielmi, and in *Bohemia*, Bohemici, whereof they have alſo 12 Pieces dividedly for 12 Pence, which Penny is 2 Hellers in Account all over *Germany*.

2. 6. *Goa*, their common Account is by their ordinary Silver Coin a *Pardaune Xeraſin*, having

the Image of St. *Sebaſtian* on one Side, and 3 or 4 Arrows bound together at the other, which is worth 3 Teſtons, or 300 Res of *Portugal*, but varieth as the Exchange riſeth or falleth; and accordingly their other Coins and Accounts, of which ſome are imaginary and ſome real. They have alſo ſome good and ſome bad Monies; for 4 good Tanga's or 5 bad Tanga's are reckoned to value 1 Pardaune Xeraſin, and 1 Tanga is 75 Baſarves. Of theſe Baſarves 375 make 1 Pardaune Xeraſin, and 15 good Baſarves are valued at 18 bad, which are made of bad Tin. By theſe other Country Coins are rated, as the Larin of *Perſia* is worth 105, and 108 Baſarves, as the Exchange goes. A Pardaune of Larins is 5 Larins, and the Crowns of *Venice* or *Turkey* are almoſt worth 2 Pardaune Xeraſins. They have alſo a Pagod, or Gold Crown, on which is the figure of their Idol, worth about 8 Tanga's; and Gold Crowns of St. *Thomas*, with his Image on them, eſteemed at 7 or 8 Tanga's.

1. 1. *Hamborough*, their Dollar was firſt coined at 31 Shillings Lups, and many Years current for 33, is now haunced to 54*s.* Lups, of 3 white Penny, and every Shilling is 12*d.* and every Penny 2 Hellers. They account by Marks of 16*s.* *Lubiſh*, and 12*d.* to the Shilling; but exchange for *London* upon the Pound Sterling, and for other Places on the Rix Dollar of 33*s.* now by them inhaunced to 54*s.* *Lubiſh*, or ſo many Stivers *Flemiſh.*

1. 8. *Henault*, as *Antois.*

1. 4. *Hungaria*, account by Guilders of 10 Shillings, of 33*d.* to the Shilling: and exchange on the Ducat and Rix Dollar, worth 8 Shillings, formerly but 7*s*, 6*d.*

1. 6. *Ireland*, they, as the *Engliſh*, account by Pounds of 20 Shilling Sterling, and Pence of 12 to the Shilling; only their Harper, valued in *England* but 9*d.* was with them counted 1*s.* ſo as their Pound is but ¾ of ours, or 15*s.* Sterling; and thereon Exchanges are made.

1. 4. *Leipſick*, as *Breſlau.*

1. 10. *Lisbon*: See *Portugal.*

1. 8. *Low Countries*, generally as before at *Brabant.*

1. 2. *London*, Exchanges are generally made for *Germany* and the *Low Countries* on the Pound Sterling; for *France* on the *French* Crown of 60 Sols *Tournois*; for *Italy*, *Spain*, and other Places, on the Ducat, Dollar or Florin, according to the Cuſtom of the Place.

1. 7. *Luca*, for divers Places in *Italy*, and *Lyons* in *France*, Exchanges are made on the Ducat.

1. 3. *Lyons*, as before in *France.*

1. 14. *Madrid*: See *Spain.*

1. 7. *Milan*, Accounts are kept by Ducats Imperial, divided by 20*s.* and 12*d.* to the Shilling, and Exchanges made on the ſame, accounting 80*s.* to the Ducat Imperial; but they buy by a Ducat current of 120*s.*

1. 7. *Naples*, they account by Ducats, Taries and Grains. The Ducat is 10 Carlini or 5 Taries, for the Tary is 2 Carlini or Royals; and hereupon Exchanges are made for moſt Places in *Italy*; but for *Lyons* they exchange by Number, as 125 Ducats for 100 Crowns.

1. 5. *Norembourgh*, the Exchange is made on the Dollar of 65 Creutzers, and many times on the Guilder of *Florin*, of 60 Creutzers, which they alſo divide into 20*s.* and every Shilling into 12*d.* to keep Accounts by; and ſome ſay the Creutzer is 4*d.* every Penny is 2 Hellers, and 5*d.* is called a *Fynſer* or 5 Pennick.

1. 7. *Palermo*, the Ducat is 13 Taries, 1 Tary 2 Carlini, 5 Ryals of *Spain* are 6 Taries. They account by Ounces of 30 Taries, to 20 Grains every Tary, and every Grain 6 Piccolie. And their Exchanges are made upon Florins of 6 Taries or Tarii.

1. 3. *Paris*, as before in *France.*

1. 9. *Poland*, they account by Marks, and exchange on the Dollar, and alſo on the Florin of 48*s.* The Mark is one third Part of it.

1. 4. *Pomerania*, they divide their Money as in the next Table following, account by Marks of 16 Snudens, and exchange upon the Rix Dollar of 32*s.* or 2 Marks Snudens, ſo called to diſtinguiſh them from Marks-Lups and Shillings-Lups.

	Marks-Snudens.	*Lups-Shillings.*	*Shillings-Snudens.*	*Pence.*	*Hellers.*
Rix-Dollar, Mark-Lups	2	16	32	384	768
	Mark-Snuden.	8	16	192	384
		Shilling-Lups.	2	24	84
			Shilling-Snuden.	21	24
				Penny.	2

1. 10. *Portugal*, they account by *Milrais*, Ducats or Cruſado's, *&c.* as in the Table following, and exchange by the ſame Ducat of 400 Rais.

	Ducats, or Cruſado's.	*Teſtons*	*Rials.*	*Vintaines, or Half Rial.*	*Raies.*
Mill-Raies.	2½	10	25	50	1000
	Ducat, or Cruſado.	4	10	20	400
		Teſton.	2½	5	100
			Rial.	2	40
				Vintaine, or Half Rial.	20

Of theſe Ducats, Rials (or Royals) and Raies (wrote alſo Reas, Reyſe and Res) are moſt in uſe for Account. They have Teſtons alſo of 4 Vintaines; 40 Raies are commonly accounted for ſix Pence Sterling, and ſo accordingly were the other Coins valued till the late Advance, whereby the Teſton of 100 Raies were ſtamped and made current for 120 Raies, and ſo rated at 1 *s.* 6 *d.* Sterling, when before but 1 *s.* 3 *d.*

1. 7. *Puglia*, as *Calabria.*

1. 9. *Riga*, they buy by Dollars or Florins *Poliſh* of 18 Farthings, whereof 11 make 10 Dollars, but they exchange upon the Rix Dollar.

1. 3. *Roan*, as before in *France.*

1. 7. *Roan* Accounts and Exchanges are performed by Ducats *di Cameri*, of 13 July or Guili, every Ducat, which they divide into 20 *s.* and every Shilling into 12 *d.*

1. 11. } *Ruſſia*, they have ſmall Coin of 11 Oz.
2. 10. } 2 Penny Weight fine, called *Dengen*, whereof 320 Pieces weigh but a Mark of 8 Oz. They exchange upon the Dollar of *Germany*; but for *London* upon their Rubble, which is valued as a double Ducat, formerly accounted to a Mark Sterling, or 13 *s.* 4 *d.*

1. 14. *Saragoſſa*, as *Arragon.*

1. 12. *Scotland*, they account by Pounds, Shillings and Pence as in *England*, but one Pound *Scotch* is but 20 *d. Engliſh*. Their Mark is 13$\frac{1}{3}$ *s.* *Scotch*, current in *England* at 13 *d.* $\frac{1}{2}$. Their Noble or half Mark with them 6$\frac{2}{3}$ *s.* with us 6$\frac{3}{4}$ *d.* their half Noble and third Part of their Noble proportionably. They have alſo Turnoners, Pence and Half-pence; and baſe Money of Bodles, Achiſons, Babees, Placks, *&c.* accounting 6 Bodles to 1 *d.* Sterling, or 12 *d. Scotch*; 4 Bodles to 1 Achiſon, 3 to 1 Babee, and 2 to 1 Plack; but they exchange upon their Mark.

1. 14. *Spain*, as in *Madrid*, *Sevil*, and other Places their Accounts are kept by Malvedies, or Marvedies (wrote alſo Merveides and Meravides) whereof 375 are eſteemed to make a Ducat of 11 Rials, tho' really every Rial is 34 *Marveides*, and ſo maketh but 374, as in the Table following; and ſo others keep Accounts accordingly. Exchange is made on this imaginary Ducat of 375 Marveides, to be paid in Bank with 5 on the 1000, which is the Salary of the Banker; or without the Bank to be paid without the ſame.

	Pieces of Eight.	*Rials.*	*Quartilio's.*	*Marveides.*	*Carnado's.*
Ducat.	1$\frac{1}{8}$	11	44	374	2244
	Piece of Eight.	8	32	272	1632
		Rial.	4	34	204
			Quartilio.	8$\frac{1}{2}$	51
				Marveid.	6

A Rial is about 6$\frac{1}{2}$ *d.* Sterling.

1. 4. *Strasborough*, or *Strausburgh*, they have Blapharts, Groſs, Behemico's, all current for 3 Creutzers a-piece, 1 Creutzer at 2 *d.* one Penny at 2 Hellers, and 1 Heller at 2 Orthings.

1. 15. *Sweden*, they reckon by Marks, whereof 8 make a Dollar, whereupon they exchange: And 2 Marks make a Clipping of 9$\frac{1}{2}$ Stivers.

1. 4. *Tirol*, the Dollar is 72 Creutzers, and the Creutzer 5 Fynfers or Hellars.

2. 11. *Tripoli*, as *Aleppo.*

1. 14. *Valentia*, as *Arragon.*

1. 7. *Venice*, Thirty Bats make 1 Souldey, and 20 Souldeys 1 Livre of *Venice*. Their Gold Ducat is valued equal to 40 Maides of *Alexandria*. They have alſo Copper Money, 1 Seſſini make 2 Quatrini, and 1 Quatrine 4 Bagatini, and ſo 3 Quatrini, or 12 Bagatini make an Half-penny Sterling, or thereabouts.

They account by Pounds *Flemiſh* of 10 Ducats of 20 Shillings, and divide the Ducat into 24 Groſs, and the Shilling into 12 *d.* and alſo by the Ducat 124 *s.* called *Ducato di Banco*, or Currant, and thereupon Exchanges are made.

1. 7. *Verona*, their Accounts are kept by 20 *s.* and 12 *d.* to the Shillings; and they exchange upon the Ducat of 93 *s.*

1. 4. *Vienna*, both Accounts and Exchanges are kept and made by Guilders or Florins of 8 *s.* a-piece, 30 *d.* to the Shilling, and 2 Hellers to the Penny.

They eſteem the Rix Dollars at 8 *s.* and the Ducat at 12 *s.*

1. 4. *Ulm*, they reckon by Pounds of 20 *s.* and 12 Hellers to the Shilling; and exchange on the Dollar of 60 Creutzers.

	FOREIGN GOLD.	Fine.		Pieces to the lb. Tr.	Weight by Malines.		Weight by others.		Old Value.			New Value.		
		Car.	gr.		pwts.	gr.	pwts.	gr.	l.	s.	a.	l.	s.	d.
	Albertines. See *Ducats.*													
	Angels with 3 Lions	22	0	76	3	$3\frac{3}{4}$	3	$3\frac{3}{4}$	0	8	6	0	11	$0\frac{1}{2}$
	Angels with O	23	0	72	3	8	3	6	0	9	0	0	12	$2\frac{1}{4}$
Angels of	*Batenborgh*	21	3	72	3	8	3	6	0	9	0	0	11	$6\frac{1}{4}$
	Flanders, or beſt *Flemiſh* Angel	23	0	72	3	8	3	6	0	9	0	0	12	$2\frac{1}{4}$
	H. M.	17	0	72	3	8	3	6	0	9	0	0	9	0
	Horne	23	$1\frac{1}{2}$	72	3	8	3	6	0	9	6	0	12	$4\frac{3}{4}$
	Thoron	22	$1\frac{1}{2}$	72	3	8	3	6	0	9	0	0	11	$10\frac{1}{4}$
	Vienna	18	3	72	3	8	3	6	0	7	6	0	9	$11\frac{1}{4}$
	Chaſtillion	23	3	$79\frac{3}{4}$	3	$0\frac{72}{119}$	2	33	0	8	10	0	11	$4\frac{1}{4}$
	Croſs Daggers of *Scotland*	22	0	72	3	8	3	6	0	11	0	0	11	8
	The Half thereof	22	0	144	1	16	1	15	0	5	0	0	5	10
Crowns	*Flemiſh* Crown	22	0	108	2	$5\frac{1}{3}$	2	5	0	6	6	0	7	$9\frac{1}{4}$
	Floret Crown of *France*	23	3	$100\frac{1}{2}$	2	$9\frac{21}{67}$	2	9	0	7	0	0	9	$8\frac{1}{4}$
	Charles's *French* Crown	23	3	$100\frac{1}{2}$	2	$9\frac{21}{67}$	2	9	0	7	0	0	9	$0\frac{1}{4}$
	Old *French* Crown	22	0	108	2	$5\frac{1}{3}$	2	5	0	6	0	0	7	$9\frac{1}{4}$
	New *French* Crown Some	22	0	$107\frac{1}{2}$	2	$5\frac{25}{43}$	2	$5\frac{1}{2}$	0	6	0	0	7	$9\frac{3}{4}$
	New *French* Crown Others	22	0	108	2	$5\frac{1}{3}$	2	5	0	6	0	0	7	$9\frac{1}{4}$
	Half Imperial Cown	22	$1\frac{1}{2}$	$107\frac{1}{2}$	2	$6\frac{25}{43}$	2	$6\frac{1}{2}$	0	6	0	0	7	$9\frac{3}{4}$
	Four Crowns of *Portugal*	—	—	—	—	—	—	—	0	6	2	0	7	$11\frac{1}{4}$
	Italian Crown	—	—	—	—	—	—	—	1	6	0	0	10	0
	King *Philip*'s Crown of *Spain*	22	$1\frac{1}{2}$	$107\frac{1}{2}$	2	$5\frac{25}{43}$	2	$5\frac{1}{2}$	0	6	0	0	7	$11\frac{1}{4}$
	Scotch Crown	22	0	108	2	$5\frac{1}{3}$	2	5	0	6	0	0	7	$9\frac{1}{4}$
	Thiſtle Crown	22	0	186	1	$6\frac{30}{31}$	1	$6\frac{3}{4}$	0	4	$4\frac{3}{4}$	0	4	6
Cruſado's	or Ducat with the † of *Portugal*	22	1	105	2	$6\frac{6}{7}$	2	$6\frac{1}{2}$	0	6	0	0	8	1
	or Ducat with the ┼ of *Portugal*	22	3	105	2	$6\frac{6}{7}$	2	$6\frac{1}{2}$	0	6	2	0	8	$3\frac{1}{4}$
	Great Cruſado, or the *Portugueſe* of *Emanuel* of *Portug.*	23	3	$10\frac{1}{2}$	22	$20\frac{4}{7}$	22	16	3	8	0	4	6	$4\frac{1}{4}$
	Joannes Great Cruſado	22	3	$10\frac{1}{2}$	22	$20\frac{4}{7}$	22	16	3	5	0	4	2	$8\frac{1}{2}$
	Dublion of *Spain*	—	—	—	—	—	—	—	0	14	6	0	15	2
Ducats of	Albertus, or Albertines Single	23	$3\frac{1}{2}$	105	2	$6\frac{6}{7}$	2	$6\frac{1}{2}$	0	6	6	0	8	8
	Albertus, or Albertines Double	23	$3\frac{1}{2}$	$52\frac{1}{2}$	4	$13\frac{5}{7}$	4	13	0	13	0	0	17	4
	Albertus of *Auſtria* Single	23	3	$78\frac{3}{4}$	3	$1\frac{1}{7}$	3	0	0	9	0	0	11	$5\frac{3}{4}$
	Albertus of *Auſtria* Double	23	3	$52\frac{1}{2}$	4	$13\frac{5}{7}$	4	13	0	13	6	0	17	$3\frac{1}{4}$
	$\frac{2}{3}$ Parts of the ſame Double Ducat	23	3	$70\frac{1}{2}$	3	$9\frac{33}{47}$	3	9	0	10	0	0	12	$10\frac{1}{4}$
	$\frac{1}{3}$ Part of the ſame Double Ducat	23	3	126	1	$21\frac{5}{7}$	1	$21\frac{1}{2}$	0	5	7	0	7	2
	Arragon	23	3	105	2	$6\frac{6}{7}$	2	$6\frac{1}{2}$	0	6	6	0	8	$7\frac{1}{2}$
	Barbary, and elſewhere in *Turkey* Some	23	$0\frac{1}{2}$	$106\frac{1}{2}$	2	$6\frac{6}{71}$	2	6	0	6	4	0	8	$3\frac{1}{2}$
	Barbary, and elſewhere in *Turkey* Others	23	3	$106\frac{1}{2}$	2	$6\frac{6}{71}$	2	6	0	6	6	0	8	$6\frac{1}{4}$
	Batenborgh with the †	19	0	105	2	$6\frac{6}{7}$	2	$6\frac{1}{2}$	0	5	2	0	6	11
	Biſhop's Ducat	23	$0\frac{1}{2}$	105	2	$6\frac{6}{7}$	2	$6\frac{1}{2}$	0	6	3	0	8	$5\frac{1}{2}$
	Caſtile	23	3	105	2	$6\frac{6}{7}$	2	$6\frac{1}{2}$	0	6	6	0	8	$7\frac{1}{2}$
	Denmark	20	0	$106\frac{1}{2}$	2	$6\frac{6}{71}$	2	6	0	5	4	0	7	2
	Emanuel of *Portugal*	23	3	105	2	$6\frac{6}{7}$	2	$6\frac{1}{2}$	0	6	6	0	8	$7\frac{1}{2}$
	Ferdinand and *Carolus* of *Rome*	18	0	$106\frac{1}{2}$	2	$6\frac{6}{71}$	2	6	0	4	10	0	6	$5\frac{1}{4}$
	Ferdinand of *Batenborgh*	19	$0\frac{1}{2}$	$106\frac{1}{2}$	2	$6\frac{6}{71}$	2	6	0	5	2	0	6	$10\frac{1}{4}$
	Florence	23	1	108	2	$5\frac{1}{3}$	2	5	0	6	4	0	8	$2\frac{1}{2}$
	George Rechem	21	3	$106\frac{1}{2}$	1	$6\frac{6}{71}$	1	6	0	6	1	0	7	$9\frac{1}{2}$
	Guelders	23	1	$106\frac{1}{2}$	2	$6\frac{6}{71}$	2	6	0	6	3	0	8	4
	Gulielmus of *Batenborgh*	21	3	$52\frac{1}{2}$	4	$13\frac{5}{7}$	4	13	0	12	4	0	15	$9\frac{3}{4}$
	Hamborough	—	—	—	—	—	—	—	0	7	2	0	8	9
	Holland	23	2	105	2	$6\frac{6}{7}$	2	6	0	6	5	0	8	$6\frac{1}{4}$
	Hungary, or Half-Noble	23	$3\frac{1}{6}$	$113\frac{1}{2}$	2	$2\frac{170}{227}$	2	$2\frac{1}{2}$	0	6	4	0	8	0
	Other *Hungary* Ducats	23	1	$104\frac{1}{1}$	2	$7\frac{25}{209}$	2	$7\frac{1}{2}$	0	6	4	0	8	$5\frac{3}{4}$
	Italy, Some, as *Venice*													
	Italy, Others	23	1	$106\frac{2}{5}$	2	$6\frac{6}{75}$	2	6	0	6	3	0	8	4

	FOREIGN GOLD.	Fine.		Pieces to the lb. Tr.	Weight by Malines.		Weight by others.		Old Value.			New Value.		
		Car.	gr.		pwts.	gr.	pwts.	gr	l.	s.	a.	l.	s.	d.
Ducats of	*Majorca*	23	1	$52\frac{1}{2}$	4	$13\frac{5}{7}$	4	13	0	13	0	0	16	$10\frac{3}{4}$
	Mary of *Batenborgh*	20	$0\frac{1}{2}$	$106\frac{1}{2}$	2	$6\frac{6}{71}$	2	6	0	5	4	0	7	$2\frac{1}{2}$
	Navarre, and ſome others, as *Majorca*.													
	Nimmeghen with *Stephen*	21	1	$52\frac{1}{2}$	4	$13\frac{5}{7}$	4	13	0	12	8	0	5	$5\frac{1}{2}$
	Nimmeghen of 1665	18	2	108	2	$5\frac{1}{3}$	2	5	0	4	10	0	6	$6\frac{1}{2}$
	Oſwald Ducat *Cruſa*	19	$0\frac{1}{2}$	$106\frac{1}{2}$	2	$6\frac{6}{71}$	2	6	0	5	2	0	6	$10\frac{1}{4}$
	Pancratius Alleb. H. as *Oſwald.*													
	Peter Rechem, as *Geo. Rechem.*													
	Portugal; ſee *Cruſado's*, *Milreys.*													
	Rome, Single Some	23	3	105	2	$6\frac{6}{7}$	2	$6\frac{1}{2}$	0	6	6	0	8	$7\frac{1}{2}$
	Others	23	3	$106\frac{1}{2}$	2	$6\frac{6}{71}$	2	6	0	6	6	0	8	$6\frac{1}{4}$
	Rome, Double	23	3	$52\frac{1}{2}$	4	$13\frac{5}{7}$	4	13	0	13	0	0	17	3
	S. Victor Rancratius, as *Geo. Rechem.*													
	Spain Single Some	23	1	105	2	$6\frac{6}{7}$	2	$6\frac{1}{2}$	0	6	6	0	8	$5\frac{1}{4}$
	Others	23	2	105	2	$6\frac{6}{7}$	2	6	0	6	6	0	8	$6\frac{1}{2}$
	Double	23	2	$52\frac{1}{2}$	4	$13\frac{5}{7}$	4	13	0	13	0	0	17	1
	Great	22	0	24	10	0	10	0	1	10	0	1	15	0
	States of the United Provinces with Letters	22	0	$52\frac{1}{2}$	4	$13\frac{5}{7}$	4	13	0	12	4	0	16	0
	The Half thereof	22	0	105	2	$6\frac{6}{7}$	2	$6\frac{1}{2}$	0	6	2	0	8	0
	Stephanus of *Batenborgh*	19	$0\frac{1}{2}$	$52\frac{1}{2}$	4	$13\frac{5}{7}$	4	13	0	10	5	0	13	$10\frac{3}{4}$
	Suevia	23	1	$104\frac{1}{2}$	2	$7\frac{25}{209}$	2	7	0	6	3	0	8	$5\frac{3}{4}$
	Valence	23	3	105	2	$6\frac{6}{7}$	2	$6\frac{1}{2}$	0	6	6	0	8	$7\frac{1}{2}$
	Venice	23	3	$106\frac{1}{2}$	2	$6\frac{6}{71}$	2	6	0	6	6	0	8	$6\frac{3}{4}$
	Victor Batenborgh, as *Geo. Rechem*													
	Victor H. B. as *Mary* of *Batenborgh.*													
	W.B. *Margaret Toren*	21	3	$106\frac{1}{2}$	2	$6\frac{6}{71}$	2	6	0	6	1	0	7	$9\frac{1}{2}$
	Water Ducats, as *Mary* of *Batenborgh.*													
	Zeland, Single	23	$0\frac{1}{2}$	105	2	$6\frac{6}{7}$	2	$6\frac{1}{2}$	0	6	3	0	8	$5\frac{1}{2}$
	Double	23	$0\frac{1}{2}$	$52\frac{1}{2}$	4	13	4	$13\frac{5}{7}$	0	12	6	0	16	11
	Ducat with the Chequer, as *Denmark.*													
	Floret of *France*	22	0	$100\frac{1}{2}$	2	$9\frac{21}{67}$	2	3	0	6	5	0	8	$4\frac{1}{4}$
	The *New Floret*; ſee *Golden St.* And													
	Golden Fleece, or *Toyſon d'Or*	23	$3\frac{1}{4}$	$81\frac{1}{6}$	2	$22\frac{470}{487}$	2	$22\frac{3}{4}$	0	9	2	0	11	$3\frac{1}{4}$
	Golden Guilder, or *Gildren*	18	3	$112\frac{1}{2}$	2	$3\frac{1}{7}$	2	6	0	4	6	0	6	$4\frac{1}{4}$
Guilders of	*St. Andrew*, Old	18	1	108	2	$5\frac{1}{3}$	2	$3\frac{1}{4}$	0	4	10	0	6	$5\frac{1}{4}$
	New, or *Floret*	18	3	108	2	$5\frac{1}{3}$	2	3	0	5	0	0	6	$7\frac{1}{2}$
	Arnoldus	12	0	138	1	$17\frac{17}{23}$	1	$17\frac{1}{2}$	0	2	7	0	3	$3\frac{3}{4}$
	Carolus	14	0	126	1	$21\frac{6}{7}$	1	$21\frac{1}{8}$	0	3	6	0	4	$2\frac{1}{4}$
	Clemmer	13	0	114	2	$2\frac{10}{19}$	2	2	0	3	6	0	4	$4\frac{1}{4}$
	Collen	17	3	114	2	$2\frac{10}{19}$	2	$2\frac{3}{4}$	0	4	8	0	5	$11\frac{1}{4}$
	David of the *Harp*	15	0	114	2	$2\frac{10}{19}$	2	2	0	4	0	0	5	$0\frac{1}{4}$
	Triers	17	2	114	2	$2\frac{10}{19}$	2	2	0	4	8	0	5	$10\frac{3}{4}$
	Utrecht	16	0	114	2	$2\frac{10}{19}$	2	2	0	4	3	0	5	$4\frac{3}{4}$
	Frederick of *Bavaria*	14	0	117	2	$1\frac{3}{13}$	2	1	0	3	8	0	4	$6\frac{7}{8}$
	Gulielmus	18	1	108	2	$5\frac{1}{3}$	2	5	0	5	10	0	6	$5\frac{1}{4}$
	Horne	—	—	$158\frac{3}{4}$	1	$12\frac{36}{127}$	1	$12\frac{1}{4}$	0	4	11	0	6	4
	Joannes	16	0	$109\frac{1}{2}$	2	$4\frac{44}{73}$	2	$4\frac{1}{2}$	0	4	6	0	5	7
	Peter of *Louvaine*	17	$0\frac{1}{2}$	114	2	$2\frac{10}{19}$	2	2	0	4	5	0	5	$8\frac{3}{4}$

	FOREIGN GOLD.	Fine.		Pieces to the lb. Tr	Weight by Malines.		Weight by others.		Old Value.			New Value.		
		Car.	gr		pwts.	gr	pwts.	gr.	l.	s.	d.	l.	s.	d.
Guilders of	*Philip*	15	3	111	2	$3\frac{33}{37}$	2	$3\frac{1}{4}$	0	4	2	0	5	5
	The Half thereof	15	3	222	1	$1\frac{35}{37}$	1	$1\frac{5}{8}$	0	2	1	0	2	$8\frac{1}{2}$
	Rheniſh Guilder	22	0	$102\frac{3}{4}$	1	$8\frac{24}{411}$	2	8	0	6	0	0	8	2
	Saxony	17	3	113	2	$2\frac{110}{113}$	2	$2\frac{1}{4}$	0	4	8	0	5	$11\frac{3}{4}$
	States of the *United Provinces*	20	0	$120\frac{3}{4}$	1	$23\frac{117}{161}$	1	$23\frac{1}{2}$	0	4	8	0	6	$3\frac{3}{4}$
	Lyons, Golden Lyon of *Flanders*	20	0	$89\frac{1}{4}$	1	$16\frac{64}{119}$	2	$16\frac{1}{2}$	0	7	8	0	10	$1\frac{3}{4}$
	$\frac{2}{3}$ Parts thereof	23	3	$133\frac{7}{8}$	1	$19\frac{3}{119}$	1	19	0	4	11	0	6	9
	$\frac{1}{4}$ Part thereof	23	3	$267\frac{3}{4}$	0	$21\frac{61}{119}$	0	$21\frac{1}{2}$	0	2	5	0	3	$4\frac{1}{2}$
	Louis's of *Louis* XIII and XIV of *France*	22	0	54	4	$10\frac{2}{3}$	4	8	0	15	0	0	15	$6\frac{1}{2}$
	The Half thereof	22	0	108	2	$5\frac{3}{4}$	2	4	0	7	6	0	7	$9\frac{3}{4}$
Marks & Milreys	Mark of *Bohemia*	—	—	—	—	—	—	—	0	6	0	0	7	6
	20 Marks of *Scotland*	22	0	36	6	16	6	10	1	2	0	1	3	4
	10 Marks of *Scotland*	22	0	72	3	8	3	3	0	11	0	0	11	8
	5 Marks of *Scotland*	22	0	144	1	16	1	14	0	5	6	0	5	10
	6 Marks of *Suevia*	—	—	—	—	—	—	—	0	4	9	0	6	0
	Milreys or Ducan of *Portugal*	22	1	48	5	0	4	20	0	13	4	0	17	$8\frac{1}{4}$
	Half Milreys	22	1	96	2	12	2	10	0	6	8	0	8	10
	Counterfeit Milreys	21	0	48	5	0	4	20	0	12	6	0	16	$8\frac{1}{2}$
Nobles of	*Bridges*	23	0	$88\frac{1}{2}$	2	$17\frac{5}{97}$	2	17	0	7	4	0	9	11
	Half *Flemiſh* Noble	23	0	108	2	$5\frac{1}{3}$	2	5	0	6	0	0	8	$1\frac{1}{2}$
	Flanders, or *Flemiſh* Noble	33	0	54	4	$10\frac{2}{3}$	4	10	0	12	0	0	16	3
	Gaunt	23	0	54	4	$10\frac{2}{3}$	4	10	0	12	0	0	16	3
	Half Noble, as the *Hungary* Ducat.													
	Half Noble, with the Lion, as *Bridges*.													
	Henry's Noble of *France*	22	0	51	4	$16\frac{16}{17}$	4	16	0	13	4	0	16	$5\frac{1}{2}$
	The Half thereof	22	$2\frac{1}{2}$	108	2	$5\frac{1}{3}$	2	5	0	6	8	0	7	$7\frac{1}{4}$
	Holland	23	2	48	5	0	4	20	0	14	3	0	18	$10\frac{3}{4}$
	Overyſſel and Utrecht, as *Holland.*													
	Zealand, as *Gaunt.*													
	Pezo of *Peru*, by *Heylin*, P. 1064.	—	—	—	—	—	—	—	0	6	6	0	8	0
Piſtoles of	*De Lege* and *Legion*	18	0	108	2	$5\frac{1}{3}$	2	5	0	4	9	0	6	$4\frac{1}{4}$
	Italy, Some	21	$2\frac{1}{2}$	108	2	$5\frac{1}{3}$	2	5	0	5	9	0	6	$7\frac{1}{2}$
	Italy, Others	22	0	108	2	$5\frac{1}{3}$	2	5	0	5	10	0	7	$9\frac{1}{4}$
	Scotland	19	$2\frac{1}{2}$	108	2	$5\frac{1}{3}$	2	5	0	5	3	0	6	$11\frac{1}{4}$
	Spain Single Some	21	$3\frac{1}{2}$	108	2	$5\frac{1}{3}$	2	5	0	5	10	0	7	$9\frac{1}{4}$
	Spain Single Others	22	0	108	2	$5\frac{1}{3}$	2	5	0	5	10	0	7	$9\frac{1}{4}$
	Spain Double	22	0	54	4	$10\frac{2}{3}$	4	8	0	11	8	0	15	$6\frac{1}{2}$
	Spain of 26 Ryals	22	0	45	5	8	5	6	0	14	0	0	18	8
	Portugueſe; ſee Great Cruſado of *Portugal.*													
	Bourbon	12	$0\frac{1}{2}$	$136\frac{1}{2}$	1	$18\frac{18}{91}$	1	18	0	2	7	0	3	$4\frac{3}{4}$
	Cleves	9	$0\frac{1}{2}$	156	1	$12\frac{12}{13}$	1	$12\frac{3}{4}$	0	1	9	0	2	$2\frac{3}{4}$
	Dog and Cat, as *Bourbon.*													
	Fran. Frier	9	0	156	1	$12\frac{12}{13}$	1	$12\frac{3}{4}$	0	1	8	0	2	$2\frac{1}{2}$
	Horn	10	$0\frac{1}{2}$	156	1	$12\frac{12}{13}$	1	$12\frac{3}{4}$	0	1	11	0	2	$5\frac{1}{4}$
	Juliers, or *Guliers*	9	3	156	1	$12\frac{12}{13}$	1	$12\frac{3}{4}$	0	1	10	0	2	$4\frac{1}{2}$
	Pounds 6 Pounds *Scotch*	22	0	80	3	0	3	0	0	10	0	0	10	6
	Pounds 12 Pounds *Scotch*	22	0	40	6	0	6	0	1	0	0	1	1	0
	Ryders of *Burgundy*	23	$0\frac{1}{2}$	105	2	$6\frac{6}{6}$	2	$6\frac{1}{2}$	0	6	3	0	8	$5\frac{1}{2}$
	Ryders of *Campen* and *Swoll*	12	3	114	2	$2\frac{10}{19}$	2	2	0	3	2	0	4	$3\frac{1}{4}$

	FOREIGN GOLD.	Fine.		Pieces to the lb T.	Weight by Malines.		Weight by others.		Old Value			New Value.		
		Car.	gr.		pwt.	gr.	pwts.	gr	l.	s.	d.	l.	s.	d.
Ryders of	*Deventer*, as *Campen* and *Swoll.*													
	Flanders	23	3	105	2	$6\frac{6}{7}$	2	$6\frac{1}{2}$	0	6	6	0	8	$7\frac{1}{2}$
	Freeſland, Guelders, of the Year 1583.	21	0	108	2	$5\frac{1}{3}$	2	5	0	5	6	0	7	5
	Guilders Ryder	14	0	114	2	$2\frac{10}{19}$	2	2	0	3	6	0	4	$8\frac{1}{4}$
	Guilders New Ryder	23	3	105	2	$6\frac{6}{7}$	2	$6\frac{1}{2}$	0	6	9	0	8	$7\frac{1}{2}$
	Philip Clincart	14	0	114	2	$2\frac{10}{19}$	2	2	0	3	6	0	4	$8\frac{1}{4}$
	Ryder, with the Leaves	10	$0\frac{1}{2}$	114	2	$6\frac{10}{19}$	2	2	0	2	7	0	3	4
	Scotland Some	19	$2\frac{1}{2}$											
	Scotland Others	22	0											
	States of the *United Provinces*	22	0	36	6	16	6	12	1	0	0	1	3	4
	The Half thereof	22	0	72	3	8	3	6	0	10	0	0	11	8
	Ruble of *Muſcovy* (by *Heylin*, 13 *s.* 4 *d.*	—	—	—	—	—	—	—	0	10	0	0	13	4
	Ruble of *Piland*	—	—	—	—	—	—	—	0	13	4	0	13	4
Royals or Reals of	*Auſtria*, Single	23	$3\frac{1}{2}$	$49\frac{1}{2}$	4	$20\frac{4}{11}$	4	20	0	14	4	0	18	5
	Auſtria, Double	23	$3\frac{1}{2}$	$24\frac{3}{4}$	9	$16\frac{8}{11}$	9	16	0	8	8	1	16	10
	Campen and *Swoll*	23	0	$40\frac{1}{2}$	4	$20\frac{4}{11}$	4	20	0	14	2	0	17	9
	The Half thereof	23	0	99	2	$10\frac{2}{11}$	2	10	0	7	1	0	8	$10\frac{1}{2}$
	Flanders, or the Key	23	0	$69\frac{3}{4}$	3	$10\frac{18}{31}$	3	$10\frac{1}{2}$	0	10	0	0	12	$6\frac{3}{4}$
	The Half thereof	23	0	$139\frac{1}{2}$	1	$17\frac{9}{31}$	1	$17\frac{1}{4}$	0	5	0	0	6	$3\frac{1}{4}$
	Imperial Loyal	23	$3\frac{1}{2}$	69	3	$11\frac{11}{23}$	3	11	0	11	0	0	13	$2\frac{1}{2}$
	The Half thereof	18	0	$105\frac{1}{3}$	2	$6\frac{54}{79}$	2	$6\frac{1}{2}$	0	4	11	0	6	$6\frac{1}{4}$
	Philip, with the *Spread-Eagle*	18	2	$109\frac{1}{2}$	2	$6\frac{9}{71}$	2	6	0	5	0	0	6	$7\frac{1}{2}$
	Philip of *Spain*	23	0	$69\frac{3}{4}$	3	$10\frac{18}{31}$	3	$10\frac{1}{2}$	0	10	0	0	12	$7\frac{3}{4}$
	Ship of *Flanders*, or *Sohuitken*	22	1	$109\frac{1}{2}$	2	$4\frac{44}{73}$	2	$4\frac{1}{2}$	0	6	3	0	7	9
	Shock of *Bohem*, ſome ſay 8 *s.* ſome	—	—	—	—	—	—	—	0	9	0	0	9	0
	Stiver Pieces, 9 Stiv. Pieces of *Batenborg* and *Frize*	7	1	176	1	$8\frac{8}{11}$	1	$8\frac{1}{2}$	0	1	3	0	6	$6\frac{3}{4}$
	Sultains of 120 *Aſpers*	23	1	90	2	15	2	16	0	7	0	0	9	$10\frac{1}{4}$
	Table of *China*	—	—	—	—	—	—	—	0	5	$4\frac{1}{2}$	0	7	2
	Tomam of *Perſia*, by *Heylin*, P. 839. valued at twenty Crowns, ſeemeth not to be any Coin, but a Denomination uſed in Account	—	—	—	—	—	—	—	5	0	0	5	0	0
	Unicorn of *Scotland*	22	0	$99\frac{1}{4}$	2	$10\frac{14}{397}$	2	10	0	6	0	0	8	$5\frac{1}{2}$
	Xeriffe of *Goa* in *India*, by *Heylin*	—	—	—	—	—	—	—	0	6	0	0	7	6
	—— By *Grimſtone*, P. 197. worth 300 *Res* of *Portugal.*													
	Zechines, or, *Checkeenes* of *Venice*	23	1	90	2	16	2	$15\frac{3}{4}$	0	7	6	0	9	10

	FOREIGN SILVER.	Fine.		Pieces to the lb. Troy	Weight of the Pieces.			Sterl. Value.			Value by ſome Authors.	
		oz.	pwts		oz.	pwts.	gr.	s.	d.		s.	d.
Albi of	*Bambergh*	4	18	273	0	0	$21\frac{9}{19}$	0	1	+	0	1
	Collen Some	5	10	345	0	0	$16\frac{16}{23}$	0	1	+	0	1
	Others	5	10	342	0	0	$16\frac{16}{19}$	0	1	+	0	1
	Others	5	10	179	0	1	$8\frac{32}{179}$	0	2	—	0	2
	Frankford, as *Bambergh*.											
	Mentz, as *Collen*.											
	Norembergh and *Palatine* of the *Rhine*, as *Bambergh*.											
	Trier, as *Collen*.											
	Alteen, or *Atten* of *Muſcovia*	—	—	—	0	0	0	0	0		0	4 +
	Altine of *Poland*	—	—	—	0	0	0	0	0		0	$4\frac{1}{2}$
	Angel of *Scrikelburgh*	10	$7\frac{1}{2}$	$78\frac{1}{4}$	0	3	$1\frac{1}{2}$	0	$8\frac{1}{2}$	+	0	8
	Aſper of *Turkey*	—	—	—	0	0	0	0	0		0	$1\frac{1}{4}$
	Babee of *Scotland*	—	—	—	0	0	0	0	0		0	$0\frac{1}{2}$
Batz of 4 Creutzers	*Bavaria* *Brandenburgh* *Colmograve* *Coſt* of 1530 *Friburgh* *Ottinge* *Raynsburgh* *Roy* *Scafhauſen* *Taunte*	5	7	$169\frac{1}{2}$	0	2	$4\frac{44}{73}$	0	3	+	0	3
	Kemptor half *Batz*	4	$12\frac{1}{2}$	$192\frac{1}{2}$	0	1	$5\frac{71}{77}$	0	$1\frac{1}{2}$	+	0	$1\frac{1}{2}$
	Munchien half *Batz*	4	$12\frac{1}{2}$	186	0	1	$6\frac{30}{31}$	0	$1\frac{1}{2}$	+	0	$1\frac{1}{2}$
	3 *Batz*. See *Snaphane*.											
	Bemiſh, or *Bemiſh* of *Switz*	—	—	—	0	0	0	0	0		0	$2\frac{1}{2}$
	Bianco, or *Biamço* of *Italy*	—	—	—	0	0	0	0	0		0	8
	Blanks	—	—	—	0	0	0	0	0		0	$0\frac{3}{4}$
	Half *Ruyters Blank* of *Holland*	3	0	144	0	1	16	0	$1\frac{1}{4}$	+	0	$1\frac{1}{4}$
	Boligneo	—	—	—	0	0	0	0	0		0	$0\frac{3}{4}$
	Carlini of *Italy*	—	—	—	0	0	0	0	0		0	6
	Carolus Guilder, as $\frac{2}{3}$ of the *Philip*'s *Dollar*.											
3 Carolus of	*Carolus* and *Salsburgh* *Campidona* *Erneſtus* *Frankford* *Ottingus* *Patavia* *Reynsborgh*	9	0	$78\frac{3}{4}$	0	3	$1\frac{1}{7}$	0	$7\frac{1}{4}$	+	0	7
	Cauſleto, or *Caveleto* of *Italy*	—	—	—	0	0	0	0	0		0	$3\frac{1}{4}$
	Cruciat of *John of Cleve*	8	7	$39\frac{1}{3}$	0	6	$0\frac{48}{53}$	1	$1\frac{1}{2}$	+	1	1
Cruciats, Creutzers, or Croſſes	of *Ausburgh* and *Ulm*	5	5	384	0	0	15	0	$0\frac{3}{4}$	+	0	$0\frac{3}{4}$
	of *Poland*	—	—	—	0	0	0	0	0		0	$0\frac{3}{4}$
	12 *Creutzers* of *Bavaria* *Vienna*	8	$7\frac{1}{2}$	57	0	4	$5\frac{9}{19}$	0	$9\frac{1}{2}$	+	0	9
	Other 12 *Creutzer* Pieces	8	$7\frac{1}{2}$	$61\frac{1}{2}$	0	3	$21\frac{27}{41}$	0	$8\frac{3}{4}$	+	0	9
	And ſome	10	10	$61\frac{1}{2}$	0	3	$21\frac{27}{41}$	0	11	+	0	11
	10 *Creutzers* of *Friſe* *Ravenburgh* *Salsburg* *Saxony*	8	7	$64\frac{1}{2}$	0	3	$17\frac{22}{43}$	0	$8\frac{1}{4}$	+	0	8
	6 *Creutzers* of *Insburgh*	10	10	$124\frac{1}{2}$	0	1	$22\frac{22}{83}$	0	$5\frac{1}{3}$	—	0	5
	Vienna	8	$7\frac{1}{2}$	114	0	2	$2\frac{10}{18}$	0	$4\frac{3}{4}$	+	0	5

FOREIGN SILVER.			Fine.		Pieces to the lb. Troy	Weight of the Pieces.			Sterl. Value.		Value by some Authors.	
			oz.	pwts.		oz.	pwts.	gr.	s.	d.	s.	d.
Cruciat, Creutzers, or Crosses		Other 6 *Creutz.* Pieces	10	10	123	0	1	$22\frac{34}{41}$	0	$5\frac{1}{2}$ +	0	5
	3 *Creutzers* of	*Bavaria*	4	8	375	0	0	$15\frac{9}{19}$	0	$0\frac{3}{4}$ +	0	$0\frac{3}{4}$
		Vienna	4	$8\frac{1}{3}$	129	0	1	$20\frac{23}{43}$	0	$2\frac{1}{4}$ +	0	2
		Other 3 *Creutz.* Pieces	5	10	$136\frac{1}{2}$	0	1	$80\frac{19}{92}$	0	$2\frac{1}{2}$ +	0	2
		2 *Crosses* and *Harps*	4	0	180	0	1	8	0	$1\frac{1}{4}$ +	0	$1\frac{1}{4}$
	Crowns of	*France.* See *Louis.*										
		Italy	—	—	—	—	—	—	—	—	5	0
		Turkey	—	—	—	—	—	—	—	—	6	0
		Cupstoke	—	—	—	—	—	—	—	—	1	0
	Deghen or *Denghen*	of *Muscovia* and *de Narde Russia*	11	13	$545\frac{1}{3}$	0	0	$10\frac{210}{409}$	0	$1\frac{1}{4}$ +	0	$1\frac{1}{4}$
	Denier, *Petit Denier* of	*Paris*	1	10	270	0	0	$21\frac{1}{3}$	0	$0\frac{1}{4}$ +	Not cur. in *Engl.*	
		Tor	1	10	$337\frac{1}{2}$	0	0	$17\frac{5}{15}$	0	$0\frac{1}{4}$ +		
		Dicken of a *Wing*	—	—	—	—	—	—	—	—	1	8
Dollars, or Ducats of		*Albania*, or the *Cross Dollar*	—	—	—	—	—	—	—	—	4	4
		Basil of 6 *Creutzers*	10	$13\frac{1}{2}$	15	0	16	0	3	10 +	3	10
		Batenburgh *Bohemia, Ne. Op.* *Bommel*	7	15	$13\frac{1}{2}$	0	17	$18\frac{2}{3}$	3	$1\frac{1}{4}$	3	1
		Brisgaw	10	15	15	0	16	0	3	$10\frac{1}{2}$ —	3	10
		Cambray, the 16th Part	6	10	123	0	1	$22\frac{34}{41}$	0	$3\frac{1}{4}$ +	0	3
		Christopher 45	10	10	$12\frac{3}{4}$	0	18	$19\frac{13}{17}$	4	$5\frac{1}{4}$ +	4	5
		Friesland, of 1601 See *Guelders.*	9	0	$13\frac{1}{2}$	0	17	$18\frac{2}{3}$	3	$7\frac{1}{4}$ —	3	7
	Germany, or	*Rix Dollar Ouncia*	11	5	$12\frac{1}{2}$	0	19	$4\frac{4}{5}$	4	$10\frac{1}{4}$ +	5	0
		Rix Dollar of 1567	10	12	$12\frac{1}{2}$	0	19	$4\frac{4}{5}$	4	7 +	4	7
		Others	10	13	$12\frac{1}{2}$	0	19	$4\frac{4}{5}$	4	$7\frac{1}{4}$ +	4	7
		Others	10	14	$12\frac{1}{2}$	0	19	$4\frac{4}{5}$	4	$7\frac{1}{2}$ +	4	7
		Others	11	0	$12\frac{1}{2}$	0	19	$4\frac{4}{5}$	4	2 +	4	9
		Others	11	3	$12\frac{1}{2}$	0	19	$4\frac{4}{5}$	4	$9\frac{3}{4}$ +	4	10
	Guelders and *Friesland*	Some	10	4	$14\frac{1}{2}$	0	16	$20\frac{4}{19}$	3	$10\frac{1}{4}$ +	3	10
		Others	9	0	$12\frac{3}{64}$	0	9	$22\frac{34}{257}$	4	$0\frac{1}{4}$ +	4	0
	Guelders and *Utrecht*	Some	9	0	15	0	16	0	3	$2\frac{3}{4}$ +	3	3
		Others	10	10	13	9	18	$11\frac{1}{13}$	4	$4\frac{1}{4}$ +	4	4
		Others	10	12	13	0	11	$11\frac{1}{13}$	4	$4\frac{3}{4}$ +	4	4
		See *Zutphen.*										
		Gulielmus of *Sweden*	10	10	$12\frac{3}{4}$	0	18	$19\frac{13}{17}$	4	$5\frac{1}{4}$ +	4	5
		Gustavus of *Liege* 38th	10	4	$12\frac{3}{4}$	0	18	$19\frac{13}{17}$	4	$3\frac{3}{4}$ +	4	4
		Holland	9	0	$13\frac{1}{3}$	0	18	0	3	$7\frac{3}{4}$	3	8
		Holland with the *Crown*	8	0	$13\frac{1}{3}$	0	18	0	3	$2\frac{3}{4}$	3	3
		Ismensen, as *Basil.*										
		Luneburgh	10	$16\frac{1}{2}$	15	0	16	0	3	$10\frac{3}{4}$	3	10
		Philip	10	0	$10\frac{5}{7}$	1	2	$9\frac{3}{5}$	5	$0\frac{1}{2}$ +	5	0
		Half of the *Philip's Dollar*	10	0	$21\frac{3}{7}$	0	11	$4\frac{4}{5}$	2	$6\frac{1}{4}$ +	2	6
		Fourth Part	10	0	$42\frac{6}{7}$	0	5	$14\frac{2}{5}$	1	3 +	1	3
		Fifth Part	10	0	$53\frac{4}{7}$	0	4	$11\frac{13}{25}$	1	0 +	1	0
		Tenth Part	10	0	$107\frac{1}{7}$	0	2	$5\frac{19}{3}$	0	6 +	0	6
		Twentieth Part	5	0	$107\frac{1}{4}$	0	2	$5\frac{101}{143}$	0	3 +	0	3
		Fortieth Part	5	0	$214\frac{1}{2}$	0	1	$2\frac{122}{143}$	0	$1\frac{1}{2}$ +	0	$1\frac{1}{2}$
		$\frac{2}{3}$ Parts of the same *Dollar*	10	0	$16\frac{1}{4}$	0	14	$22\frac{2}{5}$	3	4	3	4
	Poland	Some as *Batenburgh*										
		Others of 60 *Creutzers*	11	$3\frac{1}{2}$	15	0	16	0	4	$0\frac{1}{4}$ +	4	0
		Pr. of *Orange*, or *Lyon Dollar*	9	0	13	0	18	$11\frac{1}{13}$	3	$8\frac{3}{4}$ +	4	0
		Keynsburgh, as *Basil.*										
		Riga	10	$2\frac{1}{2}$	$13\frac{1}{2}$	0	17	$18\frac{2}{3}$	4	$0\frac{1}{2}$ +	4	0
		Scotland with the *Cross Daggers*	11	2	$11\frac{3}{4}$	1	0	$10\frac{10}{47}$	5	$1\frac{1}{4}$ +	5	0
		States-general of the *Un. Prov.*	9	0	$12\frac{3}{64}$	0	19	$22\frac{34}{257}$	4	$0\frac{1}{4}$ +	4	0

	FOREIGN SILVER.	Fine.		Pieces to the lb. Troy	Weight of the Pieces			Sterl. Value.		Value by ſome Authors.	
		oz.	pwts.		oz.	pwts.	gr.	s.	d.	s.	d.
Dollars, or Ducats of	*Suecia*, or Merchant's *Dollar*	—	—	—	—	—	—	—	—	3	2
	Suecia, or *Rixs*, or Imperial *Dollar*	—	—	—	—	—	—	—	—	5	2
	Tremone, as *Briſgau*.										
	Utrecht : See *Guelders*.										
	Zealand with the Eagles	9	0	$13\frac{1}{7}$	0	17	$18\frac{2}{3}$	3	$7\frac{1}{4}$ —	3	7
	Zutphen and *Guelders* of 1586	10	4	$13\frac{2}{3}$	0	17	$10\frac{19}{41}$	4	$0\frac{1}{4}$ +	4	0
	Drier	—	—	—	—	—	—	—	—	0	$0\frac{3}{4}$
	Duplus	2	0	324	0	0	$17\frac{7}{9}$	0	$0\frac{1}{4}$ +	Not cur. in *Engl.*	
	Dupli Simple	5	10	882	0	0	$6\frac{26}{49}$	0	$0\frac{1}{4}$ +		
	Dupli Mais $\frac{1}{9}$ of *Gul.* of *Turing*	2	15	440	0	6	$13\frac{1}{11}$	0	$0\frac{1}{4}$ +	Nor this.	
Duyts.	9 *Duyts Penny* of *Ch.* and *Philip*	4	14	129	0	1	$20\frac{28}{43}$	0	$2\frac{1}{4}$ +	0	$2\frac{1}{4}$
	11 *Duyts* of *Charles Limburgh*	4	15	120	0	2	0	0	$2\frac{1}{2}$ +	0	$2\frac{1}{2}$
	11 *Duyts* of *Holland*	6	0	144	0	1	16	0	$2\frac{1}{2}$ +	0	$2\frac{1}{2}$
	11 *Duyts* of *Philip* and *Mary*	11	$3\frac{1}{2}$	270	0	0	$21\frac{1}{3}$	0	$2\frac{1}{2}$ +	0	$2\frac{1}{2}$
	17 *Duyts*	10	10	147	0	1	$15\frac{2}{49}$	0	$2\frac{1}{2}$ +	0	$4\frac{1}{2}$
	17 *Duyts* of *Charles* *Guelders* *Liege* *Limburgh* *Lodowick* *Philip* *Philip* of *Flanders* 2 *Standing Lyons*	9	10	145	0	1	$15\frac{21}{29}$	0	$4\frac{1}{4}$ —	0	$4\frac{1}{2}$
	17 *Duyts* of *Sluce*	9	5	48	0	1	$14\frac{34}{47}$	0	4 +	0	4
	Flabes in the *Low-Countries*	—	—	—	—	—	—	—	—	1	4
	Finferkin	—	—	—	—	—	—	—	—	0	$0\frac{1}{2}$
	Fleece. See *Stivers.*										
	Florins by *Heylin*	—	—	—	—	—	—	—	—	3	0
	Franks of *Turkey*	—	—	—	—	—	—	—	—	2	0
	Franks of *France*, 3 to the *Crown*	10	0	$26\frac{1}{4}$	0	9	$3\frac{3}{7}$	2	$0\frac{1}{2}$ +	2	0
	Gagatta of *Italy*	—	—	—	—	—	—	—	—	0	1
	Gnibii of *Rome*	—	—	—	—	—	—	—	—	0	6
	Grot, or *Groot*	—	—	—	—	—	—	—	—	0	$1\frac{1}{4}$
Groots	Three *Grots* or *Deniers*	5	10	$117\frac{3}{4}$	0	2	$0\frac{144}{257}$	0	3 +	0	3
	5 *Groots* of *Flanders*	10	$6\frac{1}{2}$	$146\frac{1}{2}$	0	1	$15\frac{63}{293}$	0	$4\frac{1}{2}$ +	0	$4\frac{1}{2}$
	5 *Groots* of *Gaunt*	5	13	145	0	1	$15\frac{21}{29}$	0	$2\frac{1}{2}$ +	0	$2\frac{1}{2}$
	5 *Groots* of *Philip* of *Flanders*	11	3	135	0	1	$18\frac{2}{3}$	0	5 +	0	$5\frac{1}{4}$
	5 *Groots* of Others	10	14	135	0	1	$18\frac{2}{3}$	0	5 +	0	5
	$5\frac{1}{2}$ *Groots* of 1520. *Mr. Flanders*	9	14	120	0	2	0	0	$5\frac{1}{4}$ —	0	$5\frac{1}{4}$
Groſh or Groſs of	*Ambaſs*	4	$12\frac{1}{2}$	$94\frac{1}{2}$	0	2	$2\frac{20}{21}$	0	3 +	0	3
	Ausburgh Some	5	7	108	0	2	$5\frac{1}{3}$	0	3 —	0	3
	Ausburgh Others	6	$4\frac{1}{2}$	155	0	1	$13\frac{5}{31}$	0	$2\frac{1}{2}$ +	0	$2\frac{1}{2}$
	Ausburgh Others of the Batz	—	—	—	—	—	—	—	—	0	9
	Baſil	9	0	$118\frac{1}{2}$	0	2	$0\frac{48}{79}$	0	$3\frac{1}{4}$ +	0	$3\frac{1}{4}$
	Baſſaw	5	7	$116\frac{1}{2}$	0	2	$6\frac{6}{71}$	0	$3\frac{1}{4}$ +	0	$3\frac{1}{4}$
	Bohemia, $1\frac{1}{2}$ Silver Groſh	3	$7\frac{1}{2}$	87	0	2	$18\frac{6}{29}$	0	$2\frac{1}{2}$ +	0	$2\frac{1}{2}$
	Briſlaw, as *Baſſaw*.										
	Briſgrave *Campido* *Corinthia* as *Baſil*.										
	Coningſtein	5	7	108	0	2	$5\frac{1}{3}$	0	3 +	0	3
	Curienſis, as *Baſſaw*.										
	Duodena or $\frac{1}{12}$ of the Silv. *Groſh*	3	$3\frac{2}{3}$	$974\frac{1}{2}$	0	0	$6\frac{342}{583}$	0	$0\frac{1}{4}$ —	Not cur. in *En.*	
	Ferdinando of *Dantzick*	5	0	180	0	1	8	0	$1\frac{3}{4}$ +	0	2

	FOREIGN SILVER.	Fine.		Pieces to the lb. Troy	Weight of the Pieces.			Sterl. Value.		Value by some Authors.	
		oz.	pwts.		oz.	pwts.	gr.	s.	d.	s.	d.
Groſh or Groſs of	*George* and *Wormeſer*, as *Ambaſs*										
	Kemptom, as *Baſſaw*.										
	Markgrave, as *Ambaſs*.										
	Mary	—	—	—	—	—	—	—	—	0	$1\frac{1}{4}$
	Melvin, 3 Groſh of 1340	10	4	138	0	1	$17\frac{17}{23}$	0	$4\frac{3}{4}$ +	0	5
	Others	10	10	138	0	1	$17\frac{17}{23}$	0	$4\frac{3}{4}$ +	0	5
	Meyſen	—	—	—	—	—	—	—	—	0	$2\frac{3}{3}$ +
	Noiling, as *Ambaſs*.										
	Poland	—	—	—	—	—	—	—	—	0	$1\frac{1}{2}$
	Poland, 6 Groſh	6	0	$13\frac{7}{8}$	0	17	$7\frac{5}{37}$	2	4 +	2	4
	Prague	9	$12\frac{1}{2}$	180	0	1	8	0	$3\frac{1}{4}$ +	0	$3\frac{1}{4}$
	Pruſſia, 3 Groſh *alb.*	10	$10\frac{1}{2}$	138	0	1	$17\frac{17}{23}$	0	$4\frac{3}{4}$ +	0	5
	Reynsburgh	6	$4\frac{1}{2}$	155	0	1	$13\frac{5}{31}$	0	$2\frac{1}{2}$ +	0	$2\frac{1}{2}$
	Salisburgh Some	6	$2\frac{2}{5}$	$118\frac{1}{2}$	0	2	$0\frac{48}{79}$	0	$3\frac{1}{4}$ +	0	$3\frac{1}{4}$
	Others	4	$12\frac{1}{2}$	39	0	6	$3\frac{9}{12}$	0	$7\frac{1}{2}$ +	0	$7\frac{1}{2}$
	Saxony, as *Coningſtein*.										
	Scafhauyſen, as *Baſil*.										
	Sigiſmund of 1532 and 1535	10	4	69	0	3	$11\frac{11}{23}$	0	$9\frac{1}{2}$ +	0	$3\frac{1}{2}$
	Sigiſmund of *Pruſſia* 1534	10	11	69	0	3	$11\frac{11}{23}$	0	$9\frac{3}{4}$ +	0	10
	Others, with the Arms of *Dantzick*	10	$0\frac{1}{2}$	69	0	3	$11\frac{11}{23}$	0	$9\frac{1}{4}$ +	0	$9\frac{1}{4}$
	Silver Groſh, common	—	—	—	—	—	—	—	—	0	2
	Tavern, as *Baſil*.										
	Vienna	6	4	132	0	1	$19\frac{7}{11}$	0	3 +	0	3
	Half *Silver Groſh*	3	$7\frac{1}{2}$	87	0	2	$18\frac{6}{29}$	0	$2\frac{1}{2}$ +	0	$2\frac{1}{2}$
	4 *Groſh* Penny	8	0	81	0	2	$23\frac{1}{9}$	0	$6\frac{1}{4}$ +	0	6
Guilders or Guildens of	*Albertus* Double	10	15	$14\frac{3}{5}$	0	16	$10\frac{30}{73}$	4	0 —	4	0
	Single	10	15	$29\frac{1}{5}$	0	8	$5\frac{19}{73}$	2	0 —	2	0
	Half	10	15	$58\frac{2}{5}$	0	4	$2\frac{46}{73}$	1	0 —	1	0
	Quarter	10	15	$116\frac{4}{5}$	0	2	$1\frac{23}{73}$	0	6 —	0	0
	Carolus, as $\frac{2}{3}$ of the *Philip's* Dollar.										
	Flanders Silver *Guilder*	—	—	—	—	—	—	—	—	2	0
	Gulielmus of *Turin*	6	15	129	0	1	$20\frac{28}{42}$	0	$3\frac{1}{4}$ +	0	$3\frac{1}{4}$
	Harp of *Ireland*, or *Silv. Harp*	11	0	82	0	2	$22\frac{10}{41}$	0	$8\frac{1}{2}$ +	0	9
	Half *Harp*	11	0	164	0	1	$11\frac{5}{41}$	0	$4\frac{1}{4}$ +	0	$4\frac{1}{2}$
	Baſe *Iriſh Harp*	3	0	82	0	2	$22\frac{10}{41}$	0	$2\frac{1}{4}$ +	0	$2\frac{1}{4}$
	Old *Harp*	9	6	102	0	2	$8\frac{8}{17}$	0	$5\frac{3}{4}$ +	0	6
	Junctine, or *Juſtino* of *Italy*	—	—	—	—	—	—	—	—	1	6
	Lion of *Gulielmi* Some	2	5	150	0	1	$14\frac{2}{5}$	0	$0\frac{3}{4}$ +	0	1
	Others	2	5	179	0	1	$8\frac{32}{169}$	0	$0\frac{3}{4}$ +	0	1
	Livre of *France*. See *Quar. Cro.* by *Heylin*.										
	Louis of *France*	11	2	0	0	0	0	0	0	4	6
	$\frac{1}{2}$, $\frac{1}{4}$, and 8th Part accordingly										
	Lyarts of *France*, H.	3	0	0	0	0	0	0	0	Not cur. in *En.*	
	Lyre of *Geneva*	—	—	—	—	—	—	—	—	1	4
	Venice	—	—	—	—	—	—	—	—	0	9
	Maille, old *Petit Maille*	1	0	450	0	0	$12\frac{4}{5}$	0	$0\frac{1}{8}$ +	Not cur. in *En.*	
	Magenburg, 3 Arms	5	$8\frac{1}{3}$	27	0	8	$21\frac{1}{3}$	1	1 +	1	1
	Other Piece	11	$3\frac{1}{2}$	51	0	4	$16\frac{16}{17}$	1	2 +	1	2
	Mark of *Denmark*	—	—	—	—	—	—	—	—	2	2
	Mark of *Scotland*	11	2	54	0	4	$10\frac{2}{3}$	1	$1\frac{1}{4}$ +	1	$1\frac{1}{2}$
	Half and Quarter accordingly.										
	Markeſtick of *Lady Mary* *Lubeck*	10	$16\frac{1}{2}$	27	0	8	$21\frac{1}{3}$	2	2 +	2	2
	Medine of *Cairo*	—	—	—	—	—	—	—	—	0	$2\frac{1}{4}$
	Murfengio	—	—	—	—	—	—	—	—	0	11

FOREIGN SILVER.	Fine.		Pieces to the lb. Troy	Weight of the Pieces.			Sterl. Value.		Value by ſome Authors.	
	oz.	pwts.		oz.	pwts.	gr.	s.	d.	s.	d.
Nummi Dragme, Some	6	0	140	0	1	$17\frac{1}{7}$	0	$2\frac{3}{4}$ +	0	11
Nummi Dragme, Others	6	2	$118\frac{1}{2}$	0	2	$0\frac{49}{78}$	0	$3\frac{1}{4}$ +	0	3
Penny of *Bohemia* White	5	7	924	0	0	$6\frac{18}{77}$	0	$0\frac{1}{4}$ +	0	3
Penny of *Bohemia* Black	2	$13\frac{1}{2}$	990	0	0	$5\frac{9}{11}$	0	$0\frac{2}{55}$	Not cur. in *Engl.*	
Penny of *Holland*	0	19	518	0	0	$11\frac{31}{259}$	0	$0\frac{1}{9}$ —		
Penny called *Braſs Penny*	4	10	120	0	2	0	0	$2\frac{1}{4}$ +	0	2
Half thereof	4	10	240	0	1	0	0	1 +	0	1
Half *Ruyters* Black *Penny*	4	14	256	0	0	$22\frac{1}{2}$	0	1 +	0	1
Pfound, or *Pſound*	—	—	—	—	—	—	—	—	0	$4\frac{3}{4}$
Plappot	—	—	—	—	—	—	—	—	0	$2\frac{1}{2}$ +
Poali of *Italy*	—	—	—	—	—	—	—	—	0	6
Pound, 3 Pounds of *Scotland*	11	2	0	0	0	0	0	0	5	0
Polpate, as *Baldpate* of *Scotland*	11	2	0	0	0	0	0	0	0	$10\frac{1}{2}$
Half thereof	11	2	0	0	0	0	0	0	0	$5\frac{1}{4}$
Quartid'eſſe, or Quart-Crow of *France*	10	$6\frac{2}{3}$	390	0	6	$3\frac{9}{13}$	1	5 +	1	6
Quartid'eſſe, or Quart-Crow of *Lorrain*	9	$8\frac{1}{2}$	390	0	6	$3\frac{9}{13}$	1	$3\frac{1}{2}$ +	1	4
Quartid'eſſe, or Quart-Crow of *Philip* *Savoy*	10	$16\frac{1}{2}$	390	0	6	$3\frac{9}{13}$	0	6 +	1	6
Rappen Muntz	—	—	—	—	—	—	—	—	0	$2\frac{1}{2}$
Rouſtick	—	—	—	—	—	—	—	—	0	$1\frac{1}{2}$
Ryals of										
Abertus of *Auſtria*	10	15	120	0	2	0	0	$5\frac{3}{4}$	0	6
Half and Quarter accordingly.										
Pieces of his of 3 Ryals	10	15	40	0	6	0	0	$5\frac{1}{4}$ +	1	6
Italy, Some	9	17	108	0	2	$5\frac{1}{3}$	0	$5\frac{3}{4}$ +	0	6
Italy, Others	9	14	108	0	2	$5\frac{1}{3}$	0	$5\frac{3}{4}$ +	0	6
Italy, Others	9	11	108	0	2	$5\frac{1}{3}$	0	$5\frac{3}{4}$ +	0	6
Mexico 8 Ryals	11	0	$13\frac{2}{3}$	0	17	$13\frac{19}{41}$	4	4 +	4	4
Rome, Courſe *Ryals*	7	0	108	0	2	$5\frac{1}{3}$	0	4 +	0	4
Spain	11	$3\frac{1}{2}$	108	0	2	$5\frac{1}{3}$	0	$6\frac{1}{2}$ +	0	6
Spaniſh 8 Ryals, called *Pieces of Eight*	11	4	$13\frac{1}{2}$	0	17	$18\frac{2}{3}$	5	$5\frac{3}{4}$ +	4	4
States Gen. of the Un. Provinces	10	0	$10\frac{5}{7}$	0	2	$9\frac{3}{5}$	5	$0\frac{1}{2}$	5	0
The Twentieth Part of the ſame, with the Arrows, accordingly.										
Venice	11	10	96	0	2	12	0	$7\frac{3}{4}$ +	0	8
Ryder of *Guelders* and *Frieſland*	9	0	$12\frac{3}{64}$	0	19	$22\frac{93}{257}$	4	$0\frac{1}{4}$ +	4	0
Salvator of *Venice*	11	10	96	0	2	12	0	$7\frac{3}{4}$ +	0	8
Saſſenars, double	10	$6\frac{1}{2}$	$146\frac{1}{2}$	0	1	$15\frac{98}{293}$	0	$4\frac{1}{2}$ +	0	$4\frac{1}{2}$
Scaby of *Turkey*	—	—	—	—	—	—	—	—	0	6
Schaneberger	—	—	—	—	—	—	—	—	0	$1\frac{3}{4}$
Scya of *Turkey*	—	—	—	—	—	—	—	—	0	$6\frac{1}{4}$
Senube, or *Snube* of *Bohemia*	5	7	129	0	1	$20\frac{28}{43}$	0	$2\frac{1}{2}$ +	0	$2\frac{1}{4}$
Half thereof	5	7	258	0	0	$22\frac{13}{14}$	0	$1\frac{1}{4}$ +	0	$1\frac{1}{4}$
Seſtling	—	—	—	—	—	—	—	—	0	$0\frac{3}{4}$
Shillings of										
Bridges of 1582	5	0	57	0	4	$5\frac{1}{19}$	0	$5\frac{1}{2}$ +	0	5
Dantzick	—	—	—	—	—	—	—	—	0	$0\frac{1}{4}$
8 Shill. of *Dantzick* of 1541	10	12	156	0	1	$12\frac{12}{13}$	0	$4\frac{1}{4}$ +	0	4
Flanders	—	—	—	—	—	—	—	—	0	$7\frac{1}{2}$
Frieſland, of 1586	6	0	57	0	4	$5\frac{1}{19}$	0	$6\frac{3}{4}$ +	0	6
Gaunt, of 1583	7	7	54	0	4	$10\frac{2}{3}$	0	$8\frac{3}{4}$ +	0	9
Germany	—	—	—	—	—	—	—	—	0	$5\frac{1}{4}$
Guelders, as *Frieſland*.										
Hamborough	—	—	—	—	—	—	—	—	0	$9\frac{3}{4}$
Lubeck	—	—	—	—	—	—	—	—	0	$1\frac{3}{4}$
M. E. and *Philip* of *Flanders*	11	3	135	0	1	$18\frac{2}{3}$	0	$5\frac{1}{4}$ +	0	5
Scotland	—	—	—	—	—	—	—	—	0	1
Switz. of *Helvetia*	—	—	—	—	—	—	—	—	0	$1\frac{1}{4}$

		FOREIGN SILVER.	*Fine.*		*Pieces to the lb.Troy*	*Weight of thePieces.*			*Sterl. Value.*		*Value by ſome Authors.*	
			oz.	*pwts.*		*oz.*	*pwts.*	*gr.*	*s.*	*d.*	*s.*	*d.*
		Shillings of *Utrecht* *Zeland* as *Frieſland.*										
		Sicherling	—	—	—	—	—	—	—	—	0	$1\frac{1}{4}$
		Snaphanen, coined for 3 *Batz*	7	$7\frac{1}{2}$	$39\frac{3}{4}$	0	6	$0\frac{48}{53}$	1	0 +	1	0
		Snaphanen of *Cleve* *Deventer* *Nimmeghen*	7	11	48	0	5	0	0	10 +	0	10
		Soldi of *Genoa*	—	—	—	—	—	—	—	—	0	$0\frac{3}{4}$
		Soli of *Wersburgh* *Dantzick* *Pruſſia*	5	$6\frac{1}{4}$	$157\frac{1}{2}$	0	1	$12\frac{4}{7}$	0	2 +	0	2
		Souls or *Sols* of *France*	—	—	—	—	—	—	—	—	0	1
		Souls ſtamped, called *Soulx Marque*	—	—	—	—	—	—	—	—	0	$1\frac{1}{4}$
		The old *Soulx* with +	4	5	175	0	1	$8\frac{32}{35}$	0	$1\frac{1}{2}$ +	0	$2\frac{1}{4}$
		Ordinary *French Soulx*	3	10	147	0	1	$15\frac{9}{49}$	0	$1\frac{1}{2}$ +	0	$1\frac{1}{4}$
		Late *French Soulx*	3	$6\frac{1}{2}$	147	0	1	$15\frac{9}{49}$	0	$1\frac{1}{4}$ +	0	1
		Double Hand of one *Soulx*	3	15	132	0	1	$19\frac{7}{11}$	0	$1\frac{3}{4}$ +	0	$1\frac{1}{4}$
		Two *Soulx* Pieces, or *Boubles*	6	$6\frac{2}{3}$	117	0	2	$1\frac{3}{13}$	0	$3\frac{1}{2}$ —	0	3
		Four *Soulx* Pieces accordingly.										
Stivers		*Cambray*	3	5	135	0	1	$18\frac{2}{3}$	0	$1\frac{1}{2}$ +	0	$1\frac{1}{4}$
		Embden	—	—	—	—	—	—	—	—	0	$1\frac{1}{4}$
		Gaunti of 1583	3	0	$175\frac{1}{2}$	0	1	$8\frac{32}{39}$	0	1 +	0	1
		Groenghen *Liege* as *Cambray.*										
		States Gen. of the Un. Prov.	4	0	168	0	1	$10\frac{2}{7}$	0	$1\frac{1}{2}$ +	0	$1\frac{1}{4}$
		Utrecht	3	0	167	0	1	$10\frac{82}{167}$	0	1 +	0	1
		Old *Stiver*	3	$14\frac{1}{6}$	120	0	2	0	0	2 +	0	2
		New *Stiver*	3	$13\frac{1}{3}$	120	0	2	0	0	2 —	0	2
		Half *Stiver*	3	10	201	0	1	$4\frac{44}{67}$	0	1 +	0	1
		Quarter *Stiver Oort*	1	$17\frac{1}{2}$	158	0	1	$12\frac{36}{79}$	0	$0\frac{3}{4}$ +	Not cur. in *Engl.*	
		Eighth Part *Styver Duyt*	1	14	474	0	0	$12\frac{12}{79}$	0	$0\frac{1}{4}$ +		
		Old double *Stiver*	7	$7\frac{1}{2}$	120	0	2	0	0	4 —	0	4
		Old three *Stivers*	11	$3\frac{3}{4}$	120	0	2	0	0	6 +	0	6
		Old 4 *Stivers* with the *Eagle*, *Charles*, and *Philip*	7	$7\frac{1}{2}$	60	0	4	0	0	8 —	0	8
		Three *Stivers* or *Fleece*	10	10	108	0	2	$5\frac{1}{3}$	0	$6\frac{1}{4}$ +	0	6
		Flemiſh 6 Stivers	10	0	54	0	4	$10\frac{2}{3}$	0	0 +	1	0
		The *Bre*, 1492 The *Key* and *Joan* 3 *Stivers.*	10	4	156	0	1	$12\frac{12}{13}$	0	4 —	0	4
	Five Stivers of	*Cambray* Some	6	$6\frac{1}{2}$	48	0	5	0	0	$8\frac{1}{2}$ +	0	8
		Others	6	$6\frac{1}{2}$	51	0	4	$16\frac{16}{17}$	0	8	0	8
		Guelders	8	$1\frac{1}{2}$	48	0	5	0	0	$10\frac{3}{4}$ +	0	10
		Horne, as *Cambray.*										
		Liege Some	7	11	48	0	5	0	0	10 +	0	10
		Others	6	$6\frac{1}{2}$	48	0	5	0	0	$8\frac{1}{2}$ +	0	8
		Others	6	$6\frac{1}{2}$	51	0	4	$16\frac{16}{17}$	0	8 +	0	8
Teſtons, or Teaſtons		*Baden*, *Chryſoſtome*	10	$10\frac{1}{2}$	39	0	6	$3\frac{9}{13}$	1	$5\frac{1}{2}$ +	1	5
		Berne *Ottaman* *Vincent*	11	$5\frac{1}{2}$	45	0	5	8	1	4 +	1	4
		Caſtile, as *Berne*										
		Ferrare, *Hercules*, and *Alphonſus*	11	$5\frac{1}{6}$	45	0	5	8	1	4 +	1	4
		France Franciſcus	10	7	42	0	5	$17\frac{1}{7}$	1	4 —	1	4
		Friburg Nicholas, as *Berne.*										
		Geneva	10	$4\frac{1}{2}$	42	0	5	$17\frac{1}{7}$	1	$3\frac{3}{4}$ +	1	4
		Lorrain of 1524, and 1529	10	7	42	0	5	$17\frac{1}{7}$	1	4 —	1	4

	FOREIGN SILVER.	Fine.		Pieces to the lb.Troy	Weight of the Pieces.			Sterl. Value.		Value by ſome Authors.	
		oz.	pwts.		oz.	pwts.	gr.	s.	d.	s.	d.
Teſtons, or Teaſtons	*Lucerno*, *Epiſcopus*, *Mantua*, and *Francis*, as *Bern.*										
	Milan *Galleacius* and *Ludovicus*	11	$5\frac{1}{6}$	45	0	5	8	1	4 +	1	4
	Montſerat, *George* and *Guil.*	10	$4\frac{1}{2}$	42	0	5	$17\frac{1}{7}$	1	$3\frac{3}{4}$ +	1	4
	Navarre *Henric.* *Anna* — as *Baden.*										
	Portugal, Jo. V. L. —	10	7	42	0	5	$17\frac{1}{7}$	1	4 −	1	4
	Savoy Carolus Some —	11	$5\frac{1}{6}$	45	0	5	8	1	4 +	1	4
	Others —	10	$10\frac{1}{2}$	39	0	6	$3\frac{9}{13}$	1	$5\frac{1}{2}$ +	1	5
	Sedun Nicol, *Dan. Adrian* —	11	$5\frac{1}{6}$	45	0	5	8	1	4 +	1	4
	Solod, *Urſus*, as *Berne.*										
	Turones of *France* —	10	18	$26\frac{1}{4}$	0	9	$3\frac{3}{7}$	2	$2\frac{3}{4}$ +	2	2
	Vieryſers, Double —	4	10	138	0	1	$17\frac{17}{23}$	0	2 +	0	2
	Single, accordingly.										

Engliſh Coins.

4	Farthings	make 1	Penny.
12	Pence		Shilling.
20	Shillings		Pound.

	s.	d.
A Noble is — —	6	8
A Mark is — —	13	4

Spaniſh Coins.

6	Carnadoes	make 1	Marveid.
54	Marveids		Ryal, 6 *d. Engliſh.*
11	Ryals		Ducat.
8	Ryals		Piece of 8 = 4*s.En.*
4	Quartiles		Royal.

Portugal Coins.

40	Res	make 1	Ryal = 6*d.En.*
$2\frac{1}{2}$	Ryals		Teſtoon.
4	Teſtoons or 10 Ryals		Ducat.
$2\frac{1}{2}$	Ducats		Milt of Gold.

French Coins.

12	Deniers	make 1	Soul.
20	Souls		Frank or Liver.
16	Souls		Cardecu.
4	Cardecues		Crown.

Dutch Coins.

8	Pence	is a	Groot.
2	Groots		Single Stiver.
2	Single Stivers		Doub.Stiv. = $3\frac{1}{2}$*d. E.*
20	Single Stivers or 10 double Stivers —		Guilder.
6	Guilders		Pound.

Scotch Coins.

1	Small Piece	is a	$2\frac{1}{4}$ *d. Engliſh.*
3	Small Pieces		Noble = $6\frac{1}{4}$ *d. Engl.*
2	Nobles		Mark = $13\frac{1}{2}$ *d. Engl.*
3	Nobles		1 Pound = 20 *d. Engl.*

Iriſh Coins.

1 Harper is two $4\frac{1}{2}$ *d.* = 9 *d. Engliſh.*
20 Harpers is 1 *l. Iriſh*, or 15 *s. Engliſh.*

A TABLE *of* Engliſh Gold Coins, *ſhewing their Weight, Fineneſs, Value,* &c.

Names of the Pieces.	*Pieces to the lb.Tr.*	*Weight by* Malines, *&c.*				*Common Weight.*				*Pieces to the lb.Troy.*	*Fine.*		*Value.* 1640.			*Value.* 1660.			*Alloy.*
		pwns.	*gr.*	*m.*	*dr.*	*pwts.*	*gr.*	*m.*	*dr.*		*Car.*	*gr.*	*l.*	*s.*	*d.*	*l.*	*s.*	*d.*	*gr.*
Old double Roſe Noble	$23\frac{3}{5}$	10	6	8	$8\frac{40}{41}$	10	0	0	0	24	23	$3\frac{1}{2}$	1	16	4	1	18	8	5
Double Roſe Noble of *Henry* 8. *Edward* 6. *Philip* and *Mary* *Elizabeth*	24	10	0	0	0	9	22	0	0	$24\frac{1}{3}$+	23	$3\frac{1}{2}$	1	16	0	1	18	4	5
Great Sovereign of K. *James*	24	10	0	0	0	9	16	5	$3\frac{27}{71}$	$24\frac{4}{5}$	22	0	1	13	0	1	15	3	$4\frac{1}{2}$
Double Roſe Noble of K. *James*	$26\frac{2}{3}$	9	0	0	0	8	21	6	16	27	23	$3\frac{1}{2}$	1	13	0	1	25	3	$4\frac{1}{2}$
Double Royal or Real	0	9	0	0	0	8	2	3	3	$29\frac{2}{3}$+	23	$3\frac{1}{2}$	1	10	0	1	12	0	$4\frac{1}{2}$
Double old Sovereign	$27\frac{3}{5}$	8	18	8	$5\frac{19}{23}$	8	0	0	0	30	22	0	1	6	8	1	1	5	4
Beſt double Sovereign of *Hen.* 8. Double Sovereign of *Edward* 6. *Elizabeth*	30	8	0	0	0	7	4	0	0	$33\frac{1}{2}$---	22	0	1	3	10	1	5	5	4
Double Sovereign of K. *Jam.* called *Unite*, or *Jacobus*	36	6	16	0	0	6	10	16	$18\frac{18}{31}$	$37\frac{1}{3}$	22	0	1	2	0	1	3	10	3
Laureat, or 20 *s.* Piece of *James*	$39\frac{3}{5}$	6	1	9	$2\frac{2}{5}$	5	20	9	$18\frac{6}{41}$	41	22	0	1	0	0	1	1	4	3
20 Shillings Piece of *Charles* I.	40	6	0	0	0	5	20	9	$18\frac{6}{41}$	41	22	0	1	0	0	1	1	4	3
Old Roſe Noble	$46\frac{3}{4}$	5	3	4	$4\frac{120}{187}$	5	0	0	0	48	23	$3\frac{1}{2}$	0	18	1	0	19	4	$2\frac{1}{2}$
Spurre Royal of *Henry* 8. *Edward* 6. *Phil.* and *Mary* *Elizabeth*	48	5	0	0	0	4	23	0	0	$48\frac{2}{3}$+	23	$3\frac{1}{4}$	0	18	0	0	19	2	$2\frac{1}{2}$
Spurre Royal of *James*	$53\frac{1}{3}$	4	12	0	0	4	10	13	8	54	23	$0\frac{3}{4}$	0	16	6	0	17	7	$2\frac{1}{2}$
Double Noble of *Elizabeth*	0	0	0	0	0	4	10	6	16	$54\frac{1}{2}$---	23	$3\frac{1}{2}$	0	16	0	0	17	1	$2\frac{1}{2}$
Old Noble, or Noble of *Henry*	$53\frac{3}{4}$	4	11	3	$6\frac{6}{43}$	4	10	0	0	$54\frac{18}{53}$	23	$3\frac{1}{2}$	0	16	0	0	17	1	$2\frac{1}{2}$
Roſe Royal	0	0	0	0	0	4	1	1	$13\frac{1}{2}$	$59\frac{1}{3}$+	23	$3\frac{1}{2}$	0	15	0	0	16	0	$2\frac{1}{2}$
Old Sovereign	$54\frac{3}{4}$	4	9	4	$2\frac{46}{73}$	4	0	0	0	60	22	0	0	13	4	0	14	2	2
Beſt Sovereign of *Henry* Sovereign of *Edward* 6. *Elizabeth*	60	4	0	0	0	3	14	0	0	$66\frac{42}{43}$	22	0	0	11	11	0	12	8	2
Old Ang. Noble, or Ang. of *Hen.*	69	3	11	9	$13\frac{9}{23}$	3	8	0	0	72	23	$3\frac{1}{2}$	0	12	1	0	12	10	2
Laſt Angel Noble of *Henry* Angel Noble of *Edward* 6. *Ph.* and *Mary* *Elizabeth* Firſt Angel of *James*	72	3	8	0	0	3	7	5	0	$72\frac{2}{3}$+	23	$3\frac{1}{2}$	0	11	11	0	12	8	2
Sovereign of K. *James*, called *Double-Britain Crown*	72	3	0	0	0	3	5	8	$9\frac{9}{31}$	$74\frac{2}{3}$	22	0	0	11	0	0	11	9	2
George Noble	0	0	0	0	0	3	0	0	0	80	23	$3\frac{1}{2}$	0	10	10	0	11	6	2
Laſt Angel of *James*	80	3	0	0	0	2	23	2	$5\frac{1}{3}$	81	23	$3\frac{1}{2}$	0	11	11	0	11	9	2
Half Laureat of *James*	$79\frac{1}{5}$	3	0	14	$13\frac{1}{11}$	2	22	4	$21\frac{3}{41}$	82	22	0	0	10	0	0	10	8	2
Ten Shillings Piece of *Charles* I.	80	3	0	0	0	2	22	4	$21\frac{3}{41}$	82	22	0	0	10	0	0	10	8	2
Angel of *Charles*	0	0	0	0	0	2	16	14	9	89 +	23	$3\frac{1}{2}$	0	10	0	0	10	8	2
Half Spurre Royal	97	2	12	0	0	2	11	10	0	$96\frac{4}{5}$+	23	$3\frac{3}{4}$	0	9	0	0	9	7	2
Firſt Crown of K. *Henry*	$100\frac{1}{2}$	2	9	6	$6\frac{30}{67}$	2	9	0	0	$101\frac{3}{7}$	22+		0	8	0	0	8	5	2
Single Noble of *Elizabeth*	0	0	0	0	0	2	5	3	8	$108\frac{2}{3}$	23	$2\frac{1}{2}$	0	8	0	0	8	6	2
Half old Noble	$107\frac{1}{2}$	2	5	11	$15\frac{3}{43}$	2	5	0	0	$108\frac{36}{53}$	23	$3\frac{1}{2}$	0	8	0	0	8	6	2
Salute	108	2	5	6	16	2	5	0	0	$108\frac{38}{53}$	23	3	0	7	10	0	5	8	2
Baſe Crown of K. *Henry*, called *Roſe Crown*	120	2	0	0	0	1	23	0	0	$122\frac{26}{47}$	20	0	0	5	11	0	6	4	1
Crown of *Edward* 6. *Elizabeth*	120	2	0	0	0	1	19	0	0	$133\frac{41}{43}$	22	0	0	5	11	0	6	4	1
Half Angel Noble of *Henry*	138	1	17	14	$18\frac{18}{23}$	1	16	0	0	144	23	$3\frac{1}{2}$	0	6	0	0	6	5	1
Half laſt Angel of *Henry* Half Angel of *Edward* 6. *Philip* and *Mary* *Elizabeth* Half firſt Angel of *James*	144	1	16	0	0	1	15	12	12	$145\frac{1}{3}$	23	$3\frac{1}{2}$	0	5	11	0	6	4	1
Britain Crown, of *James*	144	1	16	0	0	1	14	14	$4\frac{20}{31}$	$148\frac{4}{5}$	22	0	0	5	6	0	5	10	1
Half George Noble	0	0	0	0	0	1	12	0	0	160	23	$3\frac{1}{2}$	0	5	5	0	5	9	1
Half laſt Angel of *James*	160	1	12	0	0	1	11	11	$2\frac{1}{2}$	192	23	$3\frac{1}{2}$	0	5	6	0	5	10	1
New Crown of *James*	$158\frac{1}{3}$	1	12	7	$6\frac{6}{11}$	1	11	2	$10\frac{22}{41}$	164	22	0	0	5	0	0	5	4	1
Crown of *Charles* I.	160	1	12	0	0	1	11	2	$10\frac{22}{41}$	164	22	0	0	5	0	0	5	4	1
Two Parts of Salute	162	1	11	11	$2\frac{2}{3}$	1	11	0	0	$194\frac{4}{5}$	23	3	0	5	0	0	5	7	1
Half *Henry* firſt Crown	201	1	4	13	$3\frac{15}{67}$	1	4	10	0	$202\frac{6}{7}$	22	0	0	4	0	0	4	2	1
Half Salute	216	1	2	13	8	1	2	10	0	$217\frac{19}{53}$	23	3	0	3	11	0	4	2	1
Half Roſe Crown	240	1	0	0	0	0	23	10	0	$245\frac{5}{47}$	20	0	0	2	11	0	3	2	$\frac{1}{2}$
Half-Crown of *Edward* 6. *Elizabeth*	240	1	0	0	0	0	21	10	0	$267\frac{39}{43}$	22	0	0	2	11	0	3	2	$\frac{1}{2}$
Quarter old Angel Noble	276	0	20	17	$9\frac{9}{23}$	0	20	0	0	288	23	$3\frac{1}{2}$	0	3	0	0	3	2	$\frac{1}{2}$
Quarter laſt Angel of *Henry* Quarter Angel of *Edward* 6. *Phil.* and *Mary* *Elizabeth* Quarter firſt Angel of *James*	288	0	20	0	0	0	19	16	6	$290\frac{2}{3}$	23	$3\frac{1}{2}$	0	2	11	0	3	2	$\frac{1}{2}$
Half Britain Crown of *James*	288	0	20	0	0	0	12	7	$2\frac{10}{31}$	$297\frac{3}{5}$	22	0	0	2	9	0	2	11	
Quarter laſt Angel of *James*	0	0	0	0	0	0	17	15	$13\frac{2}{3}$	324	23	$3\frac{1}{2}$	0	2	9	0	2	11	

COITION is a Word ſometimes uſed for that mutual Attraction or Tendency towards each other, which is found between Iron and the Magnet. *L.*

COLAPTICE [of Κολαπτω, *Gr.* to *carve*] is the Art of carving or cutting the Reſemblances and Figures of Natural things in Stone. The Term for the Artiſt here is *Lithoxos.*

COLARIN [in *Architecture*] is the little Frize of the Capital of the *Tuſcan* and *Dorick* Column, placed between the Aſtragal and the Annulets, which *Vitruvius* calls *Hypotrachelium.*

COLATURE is that which after boiling, or Infuſion of any Ingredients, is percolated or ſtrained thro' a Sieve or Cloth; or thro' *Hippocrates*'s *Sleeve*, as the Chymiſts ſpeak. *L.*

COLCOTHAR is the dry Subſtance, red as Blood, which remains after Diſtillation of Vitriol, commonly called *Caput Mortuum*; tho' when Vitriol is calcined a good while in a ſtrong Fire, it will turn red, and is alſo called *Colcothar.*

COLD is one of thoſe Qualities of Bodies which they call *Primary*, and is nothing but the arriving of the minute and inſenſible Parts of any Body at ſuch a State, as that they are more ſlowly or faintly agitated than thoſe of our Fingers or other Organs of Feeling; for from this Effect we pronounce any Body to be cold.

Mr. *Hobbs* thought the Cauſe of Cold to be only a Wind taking the condenſed or frozen Body.

Whether Cold be barely a Privation of Heat, or rather a Stop put to that violent tumultary Motion of the inſenſible Particles of Bodies, as the *Carteſians* aſſert; or whether Cold be introduced by the Entrance of adventitious Particles actually cold themſelves, and therefore called *Frigorifick Particles*, according to the Opinion of the learned and ingenious *Gaſſendus*, is a Controverſy not ſo eaſy to be determined as at firſt Sight it may appear. For tho' the conſiderable Increaſe of the Dimenſions of the ſame Quantity of Water when turned into Ice, and the prodigious Force of Freezing, by which Water may be made to lift up vaſt Weights, and to break to Pieces ſome of the ſtrongeſt Bodies that are; and alſo, ſince it is true, that a brisk, nay, a furious Agitation of the ſmall Parts of a Mixture may be produced, and yet on the Conflict the Mixture ſhall become not only *not Hot*, but ſenſibly and conſiderably *Cold*; tho', I ſay, theſe ſeem to bid very fair for a Proof of *Gaſſendus*'s Opinion; yet, on the other Hand, 'tis certain, that a bare Privation of Motion will produce, or rather, occaſion Effects as conſiderable as any of thoſe of Cold, as the excellent Mr. *Boyle* largely ſhews in his Dialogue about the *Poſitive* or *Privative* Nature of Cold: And alſo, if it ſhould be ask'd, how the Frigorifick Particles themſelves become cold? What Degree of Gravity or Levity they have? What kind of Structure in them is proper to produce ſuch an Effect? Whether ſuch a Structure be deſtructible or mutable, or not? Whether theſe Frigorifick Particles be primitive Bodies or not? And whether there was not Cold in the World till they were produced? If theſe or ſuch like Queries were made about the Nature and Circumſtances of the Frigorifick Particles, it would, I believe, puzzle the Maintainers of the Opinion of *Gaſſendus*, to give ſatisfactory Anſwers to them; and therefore the Deciſion of this Point muſt be ſuſpended further.

Mr. *Boyle* found, that tho' Water uſually expands itſelf in freezing, yet 'tis always firſt contracted or condenſed; and that Spirit of Wine, common expreſt Oils, and Chymical Oil of Anniſeeds itſelf, will be notably condenſed when expoſed to an intenſe Degree of Cold: And he found, that no other Liquor but Water, or one in which there are ſeveral Particles, will ever be expanded by Cold. The Reaſon of which perhaps may be, that Water contains more Air in its Pores than other Fluids; and 'tis not improbable, that from the Coaleſcence of many of the Aerial Particles into one, during the Action of Freezing, their Spring may by that means be encreaſed, and ſo they may from thoſe numerous and large Bubbles we obſerve in Ice, which occaſions it to be ſpecifically lighter than Water.

The Expanſion of Water in Freezing is about a Tenth-part of the Space more than it before took up.

The Expanſive Force of Cold is ſo great, that if the Barrel of a Gun be filled with Water, and then have its Muzzle and Touch-hole well ſtopt, the Water within the Barrel, when, either by natural Cold, or a freezing Mixture, it is turned into Ice, will break the Barrel in ſeveral Places, as Mr. *Boyle* and many others have tried.

That noble Philoſopher contrived ſeveral Experiments to eſtimate or meaſure the Quantity of this Expanſive Force, which were made with a Braſs Cylinder of two or three Inches in Diameter, into whoſe Cavity was put a Bladder filled with Water, and ſtrongly tied about the Neck, and over it was put a Wooden Plug, to ſtop up the upper Orifice of the Cylinder; and on the Plug was put a broad flat Board, on which was laid as much Weight as one time amounted to above an hundred Pounds, another time an hundred and twenty Pounds, and another time to two hundred and fifty four Pounds; and yet in all the Experiments, when the Water in the Bladder was turned into Ice, it expanded ſo as to raiſe up all this Weight very conſpicuouſly, as appeared by a Circle deſignedly made on the Wooden Plug.

He tells us alſo, That by mingling together three Saline Bodies, each of them purified by the Fire, tho' there did ariſe a very great Commotion, Hiſſing, and Exploſion, yet a very conſiderable Degree of Cold was thereby produced: And tho' he was under an Obligation of not diſcovering what theſe Ingredients were, yet he gives a Succedaneum to that Experiment, by telling us, that by putting good Salt of Tartar into Spirit of Vinegar, there was a Struggle, Commotion, and Hiſſing produced, and yet, inſtead of Heat, as is uſual in ſuch Caſes, a very ſenſible Degree of Cold was produced.

Silvius alſo acquaints us with a Method of producing Cold, by mingling Spirit of Vitriol with another Saline Spirit.

If in three or four times its Weight of Water, you put about Half a Pound of Sal Armoniack powdered, and ſtir it about to haſten the Diſſolution, ſo great a Degree of Cold will, even in the Heat of Summer, be produced, as is very ſurprizeing; for if you nimbly ſhake it, or ſtir it about, it will produce actual Ice on the Outſide of the Glaſs, if you purpoſely wet it with Water. This noble Experiment Mr. *Boyle* firſt made, and thereby plainly proved the Mechanical Producibleneſs of the Quality of Cold; and the Experiment may be of great Uſe to cool Wine, *&c.* in the hot Months, or in ſuch Places where no good Cellarage is to be had. The Sal Armoniack, by evaporating the Water from it, may be recovered again, and will ſerve many times for the ſame Experiment.

That honourable Virtuoſo found alſo, That by ſhaking Gun-powder in four or five times its Weight of common Water, a conſiderable ſenſible Coldneſs would be produced.

The Learned Dr. *Slare* produces a conſiderable Experiment (in *Philoſ. Tranſ.* N. 150.) whereby a conſiderable Degree of Cold is made with a very great Ebullition, as in the former Experiment it is produced without any. The Experiment is only to pour into any ſtrong Acid (he uſed moſtly Spirit of Verdegreaſe) a Quantity of the Volatile Spirit of Human Blood; by which means, he tells us, that he produced ſo much Cold, as that the Spirit of Wine in an immerſed Thermoſcope, deſcended within Half an Inch of the freezing Point, even in Summer: And this he thinks, very ingeniouſly, may ſerve to explain the Phænomenon of the Cold Fits in Agues.

And ſince, if into this Mixture be poured a ſmall Quantity of Oil of Sulphur, the Matter would immediately grow ſenſibly warm, he not improbably ſuggeſts, that ſomething like this may occaſion the coming of the Hot-fit afterwards, when the Animal Spirits come to be mixed with the Blood more copiouſly than at firſt in an Ague-fit they can be.

Neither our Senſes, nor common Weather-Glaſſes, can enable us to make an accurate Judgment of the Degree of Cold:

For as to our Senſes, the Organs of Feeling are in a continual State of Mutability, and that (in general) appears cold to us, which hath its Parts leſs moved than thoſe of our Hands and Bodies; and therefore, if one Hand be very cold, and the other moderately warm, the ſame Water (for Inſtance) will appear Warm to the Cold, and Cold to the Warm Hand.

As to the common Weather-Glaſſes, ſome Part of the Liquor being contiguous to the open Air, the Weight and Preſſure of the Atmoſphere hath ſo great an Effect on them, that their riſing and falling depends more on that than on Heat and Cold; and therefore they will often miſ-inform us.

The Coldneſs of Places doth not ſolely nor principally depend on their Nearneſs to the Poles.

For *Martinus*, in his *Atlas Chinenſis*, ſaith, That in *China*, whoſe Latitude is no where above 42 Degrees, the Rivers, for four Months together, (*viz.* from the Middle of *November* till the Beginning of *March*) are ſo frozen up, that loaded Waggons do ſafely paſs on the Ice; and that the Ships and Veſſels are all frozen up; and what is moſt remarkable, is, the Froſt is uſually the Reſult but of one Day's time, tho' it require many to thaw it again.

A *Dutch* Maſter of a Ship, that went within a Degree of the Pole, found the Sea open, and the Weather tolerable enough.

It hath been obſerved by Mr. *Geoffroy* (in a Diſcourſe which he read before the *French* Royal Academy of Sciences, and which is mentioned in *Philoſ. Tranſ.* N. 274.) that a Mixture of the greateſt Part of all the ſeveral Kinds of Salts, in many Liquors, is accompanied with a ſenſible Degree of Coldneſs, notwithſtanding the violent Fermentations which ſuch Mixtures do ſometimes produce: As indeed the Learned and Ingenious Dr. *Slare* had before experimented (ſee *Philoſ. Tranſ.* N. 150.) in a Mixture of an acid Menſtruum and the Volatile Spirit of Human Blood. Mr. *Geoffroy* found, that pouring but Half an Ounce of Sal Armoniack into three Ounces of Spirit of Vitriol, tho' a very violent Fermentation enſued, yet the Spirit of Wine in the included Thermometer, deſcended three Inches and a Half.

COLDSHIRE *Iron* is ſuch as is brittle when it is cold. See *Iron.*

Potential COLDNESS is a relative Quality, which Plants, *&c.* are ſuppoſed to have: Thus a Plant is ſaid to be cold in the ſecond or third Degree, not that it is actually cold to the Touch, but in its Effects, or Operations, if taken inwardly.

COLICK [of Κωλικὴ, *Gr.*] is a vehement Pain in the Abdomen, or lower Belly, and takes its Name from the Part chiefly affected, *viz.* the Gut (*Colon*) which is ſtretch'd, prick'd, and corroded, by Winds or Excrementitious Humours, either remaining within its Cavity, or fix'd to its very Coat.

COLLAR *of a Ship* is a Rope faſtened about her Beak-head, unto which the dead Man's Eye is ſeized that holds her Main-Stay. There is alſo a Collar, or Garland, about the Main-Maſt Head, which is a Rope wound about there to ſave the Shrouds from galling.

COLLATERAL *Aſſurance* is a Bond that is made over and beſide the Deed itſelf, for the Performance of Covenants between Man and Man.

COLLATERAL [in *Geography*] any Thing, Place, Country, *&c.* ſituated by the Side of another.

COLLATERAL *Winds* [of *Con* and *Latus*, *L.* *aſide*] are thoſe Winds which blow from collateral Points; *i. e.* thoſe which blow aſide of thoſe in the Cardinal Points of the Horizon, as the *North-Eaſt*, *South-Eaſt*, *North-Weſt*, *South-Weſt*, and their Sub-diviſions.

COLLATERAL *Points* [in *Coſmography*] are the intermediate Points, or thoſe between the Cardinal Points. The *Collateral Points* are either *Primary*, which are thoſe removed by an equal Angle on each Side, from two Cardinal Points; or *Secondary*, which again are either thoſe of the firſt or ſecond Order; the firſt, thoſe that are equally diſtant from a Cardinal and firſt Primary; the latter, equally diſtant from ſome Cardinal and Primary and firſt Secondary.

COLLATION is the beſtowing of a Living on a Clerk, by an Archbiſhop or Biſhop, when that Living is in the Biſhop's or Archbiſhop's own Gift: But when the Living is in the Gift of another, the Biſhop is ſaid to give the Clerk *Inſtitution* into it on the Patron's Preſentation, and the Archdeacon gives him *Induction* into it on the Biſhop's Mandate, as well from the *Collation* as *Inſtitution.*

COLLATION [in the *Common Law*] is the Compariſon or Preſentation of a Copy to its Original, to ſee whether or no it be conformable; or, the Act or Report of the Officer who made the Compariſon.

COLLATION [in a *Logical Senſe*] is the ſame as a comparing of one thing well with another; but now-a-days 'tis uſed for an *Handſome Treat* or *Entertainment.*

COLLATIONE *Heremitagii* is a Writ whereby the King confers the keeping of a Hermitage upon a Clerk. *L.*

COLLATIONE *facta uni poſt mortem alterius*, is a Writ directed to the Juſtices of the Common-Pleas, commanding them to direct their Writ to a Biſhop, for the admitting a Clerk in the Place of another preſented by the King, who, during the Suit between the King and the Biſhop's Clerk, is departed this Life. For Judgment once paſſed for the King's Clerk, and he dying before Admittance, the King may beſtow his Preſentation to another. *L.*

A Noun COLLECTIVE [with *Grammarians*] is a Term applied to a Noun that expreſſes a Multitude, tho' it be ſingular in itſelf; as, a Company, an Army, a Troop, a Flock, *&c.*

COLLEGIATE *Churches* are Churches built and endowed for a Body Corporate, of a Dean or other Preſident and Secular Prieſts; as Canons or Prebendaries in the ſaid Church; ſuch as are with us, *Weſtminſter*, *Windſor*, *Rippon*, *Wolverhampton*, *Southwell*, *Mancheſter*, *&c.* None of theſe Collegiate Churches are Epiſcopal Sees or Cathedrals.

COLLICIÆ are the Joining of the *Puncta Lachrymalia* into one Paſſage on both Sides, which derive the Humour of the Eye-lids into the Cavity of the Noſtrils. The Holes that are made in the very Tops of the Eye-brows deſcend in little Channels, they ſpread themſelves into a larger Channel, and are continued to the Tunick of the Noſtrils. The ſame Holes or Openings in Hares, Calves, and Rabbits, are not found in the very Eye-brows, but a little more inward; and moſt of all in Birds, where they are larger than in any other Creatures. The Membrane which ſeparates the Holes here is very ſhort. *L. Blanchard.*

COLLIQUANS *Febris* is one of the Nature of ordinary burning Fevers; but by its exceſſive Heat, they ſay, it ſuddenly melts the Fat, Fleſh, and Subſtance of the ſolid Parts of the Patient's Body; nay ſometimes diſſolves the very Blood in the Veins, as ſome tell you, and diſchargeth the ſame by inſenſible Tranſpiration, as Sweat, Urine, or Stool, *&c.*

COLLIQUATION, or *Melting of Metals:* Thus we ſay, Silver and Lead being melted or colliquated together over a ſtrong Fire, will mingle *per minima*, that is, unite throughly together. *L.*

COLLIQUATION [in *Medicine*] is uſed to ſignify ſuch a Temperament and Diſpoſition of the Animal Fluids, as proceeds from too lax a Compages, whereby they flow off from the ſeveral Glands, and particularly thro' thoſe of the Skin, faſter than they ought, which occaſions Fluxes of many kinds, but chiefly profuſe, greaſy Sweats.

COLLISION is the ſtriking of one hard Body againſt another, or 'tis the Friction or Percuſſion of two Bodies moving violently with different Directions, and daſhing againſt each other.

COLLUM *Minus Uteri* is the Cavity of the Womb next its internal Orifice, where it is more contracted than it is at the Bottom. *L.*

COLLUSION [in *Common Law*] is a deceitful Agreement or Compact between two or more, for the one Party to bring an Action againſt another for ſome evil Purpoſe, as to defraud a third Perſon of his Right, *&c. L.*

COLLUTIO is a waſhing of the Mouth; as, when 'tis done to clean or faſten bad or looſe Teeth, or free the Gums from Ulcers, *&c. L.*

COLLYRIUM [of Κολλύριον, *Gr.*] is an oblong or round Tablet or Trochisk, uſed formerly in Diſtempers of the Eyes, and was then called by the *Arabian* Name of *Seif* or *Sief.* It was diſſolved in a convenient Vehicle, that it might conveniently be applied; and from hence any Medicines, in a Liquid Form, deſigned to cure Diſeaſes in the Eyes, are called *Collyrium.*

COLOBOMA [of Κολόβωμα, *Gr.*] is the growing together of either Lips or Eye-lids, or the adhering of the Ears to the Head preternaturally, *&c.*

COLON [of Κῶλον, *Gr.*] is the ſecond of the great Guts, ariſing from the *Cœcum Inteſtinum* in the Right Flank, and adheres to the Right Kidney; thence it tends up into the Liver, and ſometimes is annexed to the Gall-Bladder, which dyes it of a Yellowiſh Clay-colour; thence it goes on tranſverſly under the Bottom of the Stomach, and on the Left Hand is faſtened to the Spleen; after which it is faſtened to the Left Kidney, winding and turning very obliquely there, but afterwards it deſcends almoſt in a Right Line. It is the wideſt and largeſt of all the Guts, and is uſually about 8 or 9 Hands-Breadths long; it abounds with ſmall Cells, or little Cavities, every where: It hath a Valve to hinder any thing from returning from the great Guts into the ſmall.

It is alſo a Point [in *Grammar*] mark'd thus, (:) and ſhews a Sentence to be perfect or entire, but yet the Senſe depending or continuing on; as in this of *Seneca; Ante omnia neceſſe eſt, ſeipſum æſtimare: Quia fere plus nobis videmur poſſe, quam poſſimus.*

COLONNADE [in *Architecture*] is a Range of Pillars running quite round a Building, and ſtanding within the Walls of it.

COLOUR [in a *Law Senſe*] is a Plea that is probable, tho' in truth falſe, and hath this End, to draw the Trial of the Cauſe from the Jury to the Judge.

COLOUR *of Office* is always uſed [in the *Law*] in an ill Senſe, ſignifying ſome ill Act done under Countenance of an Office; and ſo 'tis oppoſed to *Virtute Officii*, which is always taken in the beſt Senſe, and implies a Man's doing a right and juſt Thing under the Execution of his Office.

COLOUR. It hath been obſerved, that tranſparent Subſtances, as Glaſs, Water, Air, *&c.* when made very thin, by being blown into Bubbles, or otherwiſe formed into Plates, do exhibit various Colours, according to their various Thinneſs, altho' at a greater Diſtance they appear very clear and colourleſs. About theſe Sir *Iſaac Newton*, in his *Opticks*, *Book* 2. made many excellent Obſervations, ſerving to illuſtrate and demonſtrate the Theory of Colours: As,

1. By compreſſing two Priſms hard together, ſo that their Sides, which by Chance were a little convex, might ſomewhere touch, he found the Place where they touched to become abſolutely tranſparent, as if they had been there but one continued Piece of Glaſs: For when the Light fell ſo obliquely on the Air between them in other Places, as to be all reflected, it ſeemed, in the Place of Contact, to be all tranſmitted, inſomuch that when look'd upon, it appeared like a little dark Spot, and when look'd thro', it ſeemed like a Hole in that Air which was formed into a thin Plate by being compreſſed between the Glaſſes; and thro' that Hole all Objects that were beyond it might be ſeen diſtinctly, which could not be ſeen at all through other Parts of the Glaſſes where the Air was interjacent. By preſſing the Priſms hard together, this Spot would become conſiderably broader.

2. When the Plate of Air, by turning the Priſms about their common Axis, became ſo little inclin'd to the incident Rays, that ſome of them began to be tranſmitted, there aroſe many ſlender Arks of Colours in it, which increaſed by continuing the Motion of thoſe Priſms, and bended more and more about the ſaid tranſparent Spot, till they were completed into Circles or Rings encompaſſing it, and afterwards continually grew more and more contracted. Theſe Arks, at their firſt Appearance, were of a Violet and a Blue, and between were White Arks of Circles, which preſently, by continuing the Motion of the Priſms, became a little tinged in their inner Limbs with Red and Yellow,

and to their outward Limbs the Blue was adjacent. The Motion of the Priſms round their Axis being continued, theſe Colours contracted more and more, ſhrinking towards the Whiteneſs on either Side of it, 'till at laſt they totally vaniſhed into it, and then the Circles in thoſe Parts appeared Black and White, without any other Colours intermixed; but by farther moving the Priſms, the Colours would emerge out of the Whiteneſs again.

In his 4th Obſervation he conſidered more nicely the Order of the Colours ariſing out of the white Circles, according as the Rays become leſs and leſs inclined to the Plate of Air; and by uſing two Object Glaſſes of pretty long Teleſcopes, he obſerved the Succeſſion and Quantity of the Colours to be thus: Next to the Pellucid Central Spot ſucceeded Blue, White, Yellow, and Red; the Blue was ſo ſmall that he could not diſcern it in the Circles made by the Priſms, nor could he well diſtinguiſh any Violet in it; but the Yellow and Red were pretty copious, and ſeem'd about as much in Extent as the White, and four or five times more than the Blue. The next Circuit or Order of Colours ſucceeding and compaſſing theſe, were Violet, Blue, Green, Yellow, and Red; and theſe were all copious and vivid, except the Green, which was very little in Quantity, and very faint and dilate. Of the other Four, the Violet was the leaſt in Extent, and the Blue leſs than the Yellow and Red. The third Circuit or Order was Purple, Blue, Green, Yellow, and Red; in which the Purple ſeemed more reddiſh than the Violet in the former Circuit; and the Green much more conſpicuous, and as vivid and copious as any Colour there but the Yellow; but the Red began to look faded, and very much inclining to Purple. After this ſucceeded a fourth Circuit or Order of Green and Red: The Green was very copious and lively, inclining on one Side to Blue, and on the other to Yellow: But here was neither Violet, Blue, nor Yellow, and the Red was imperfect and dirty: Alſo the ſucceeding Colours became more and more imperfect and dilute, till after three or four Revolutions, they ended in perfect Whiteneſs.

In the 5th and 6th Obſervation, he determines the Thickneſs of the Air lying between the Glaſſes, by which each Colour was produced: And,

In the 7th, he gives a Table of it with all the Obliquities of the Angle of Incidence. See *Air*.

In the 9th, he ſhews, That the Air between the two Object Glaſſes exhibited Rings of Colours, as well by tranſmitting Light as by reflecting it; which he found by looking thro' the Glaſſes: But the Central Spot was now White, and the Colours oppoſite to thoſe made by Reflexion in the former Caſes; *i. e.* thoſe Parts of the Glaſs were now Black, which before were White, *& vice verſa*; and thoſe which were then Red were now Blue; likewiſe thoſe which were then Yellow were now Violet, *&c.*

In the 10th, he found, That by wetting the Object Glaſſes a little at the Edges, the Water crept ſlowly in between them, whereby the Circles became leſs, and the Colours more faint; and he found the Diameters of the coloured Circles made now by Water to thoſe before made by Air, to be about Seven to Eight; and that if any other Medium, more or leſs denſe than Water, be compreſſed between the Glaſſes, their Intervals at the Rings cauſed thereby, will be to thoſe made by Air as the Sines meaſuring the Refraction made out of that Medium into Air.

In the 12th, he found, That by viewing theſe Rings in a darkened Room, they became more viſible and diſtinct, and appeared in a greater Number.

In the 13th Obſervation, he found, That when the Priſm was made to turn round its Axis, ſo that all the Colours might ſucceſſively fall on that Part of the Paper which he ſaw by Reflexion from that Part of the Glaſſes where the Circles appeared, ſo that all the Colours might be ſucceſſively reflected from the Circles to the Eye, while it was held immoveable: He found, I ſay, That the Circles which the Red Light made, were manifeſtly bigger than thoſe made by the Blue and Violet; and it was pleaſant to ſee them gradually ſwell and contract, according as the Colour of the Light was changed. And

In the 14th Obſervation, he found then the Contraction or Dilatation of the Colours was ſwifteſt in the Red, and ſloweſt in the Violet, and in the intermediate Colours had intermediate Degrees of Celerity; and he gives you the Proportions in Numbers: And he ſhews alſo, That the Thickneſs of the Air between the Glaſſes there, where the Ring is ſucceſſively made by the Limits of the five principal Colours (Red, Yellow, Green, Blue, Violet) in order, are to one another very nearly, as the ſix Lengths of a Chord which ſound the Notes in a ſixth Major, *ſol*, *la*, *mi*, *fa*, *ſol*, *la*. But that it agrees better with Obſervation, to ſay, That the Thickneſs of the Air between the Glaſſes there, where the Rings are ſucceſſively made by the Limits of the ſeven Colours (Red, Orange, Yellow, Green, Blue, Indico, and Violet) in order, are to one another as the Cube Roots of the Squares of the eight Lengths of a Chord, which ſound the Notes in an Eighth, as *ſol*, *la*, *fa*, *ſol*, *la*, *mi*, *fa*, *ſol*; that is, as the Cube Roots of the Squares of the Numbers, 1, $\frac{8}{9}$, $\frac{5}{6}$, $\frac{3}{4}$, $\frac{3}{5}$, $\frac{9}{16}$, $\frac{1}{2}$. Then,

In the 15th Obſervation, he manifeſtly ſhews the Origin of theſe Rings; for he found that theſe Rings, in the preceding Obſervation, were not of various Colours like thoſe made in the open Air, but appeared, all over, of that Priſmatick Colour only, with which they were illuminated; and by projecting the Priſmatick Colours immediately upon the Glaſſes, he found that the Light which fell on the dark Spaces which were between the coloured Rings, was tranſmitted thro' the Glaſſes without any Variation of Colour; for on a white Paper placed behind, it would paint Rings of the ſame Colour with thoſe which were reflected, and of the Bigneſs of their immediate Spaces; ſo that 'tis plain, *That the Air between the Glaſſes, according to its various Thickneſs, is diſpoſed in ſome Places to reflect, and in others to tranſmit the Light of any one Colour, and in the ſame Place to reflect that of one Colour where it tranſmits that of another.*

In the 16th Obſervation, he found, That the Squares of the Diameters of theſe Rings were in Arithmetical Progreſſion.

In the 17th and 18th Obſervation, he conſiders the Phænomena ariſing from the Colours ſeen in Bubbles of Water, made tenacious by a little Soap. And

In the 19th Obſervation, he collects the Thickneſs of the Water requiſite to exhibit one and the ſame Colour at ſeveral Obliquities, and expreſſes their Proportions in a Table. And

In the 21ſt Obſervation, he ſhews, by Help of Obſervation 10 and 16, the Thickneſs which Plates of *Muſcovy*-Glaſs, Water, or any other Subſtances, have at any Colour exhibited by them.

In the 22d Obſervation, he found, That a thin tranſparent Body, which is denſer than its ambient Medium, exhibits more brisk and vivid Colours than that which is ſo much rarer; as he particularly obſerved in the Air and Glaſs: For blowing Glaſs very thin at a Lamp-Furnace, thoſe Plates encompaſſed with Air, did exhibit much more vivid Colours than thoſe of Air made thin between two Glaſſes. See *Obſerv.* 1 and 4.

And he ſhews farther, That ſince, by his 10th Obſervation, *the Thickneſs of Air to the Thickneſs of Water* (which between the ſame Glaſſes exhibited the ſame Colour) *was as* 4 *to* 3; and ſince it appears (by the 21ſt Obſervation) that the Colours of thin Bodies are not varied by varying the Ambient Medium; therefore *the Thickneſs of a Bubble of Water exhibiting any Colour, will be* $\frac{3}{4}$ *of the Thickneſs of Air producing the ſame Colour*: And ſo, according to Obſervation 21, the Thickneſs of a Plate of Glaſs, whoſe Refraction of the mean Refrangible Ray is meaſured by the Proportion of the Sines of 31 to 20, may be $\frac{22}{31}$ of the Thickneſs of Air producing the ſame Colours, and the like of other Mediums. And on theſe Grounds the excellent Author gives a Table, wherein the Thickneſs of Air, Water, and Glaſs, at which each Colour is moſt intenſe and ſpecifick, is expreſſed in Parts of an Inch, divided into 100000 equal Parts; and by means of this Table, he ſhews how to conjecture at the Bigneſs of the Parts of Natural Bodies by their Colours.

In the 24th Obſervation, he takes Notice of ſomething very odd and ſurpriſing; and that is, That Bubbles of Water, or of Glaſs, and Plates of *Muſcovy*-Glaſs, which are not quite thin enough to repreſent the various Colours above mentioned, yet when look'd on thro' a Priſm, ſhould appear adorn'd with Rings or Wavings; whereas a Priſm uſually makes Objects appear coloured only, where they are terminated with Shadows, or have Parts unequally luminous: And the Reaſon of this he explains largely in *p.* 42, 43, *&c.* of Book II. Part 2. And from the whole he effectually proves thoſe Properties of Light above diſcovered to be connate with the Rays, and immutable; and conſequently, that all the Productions and Appearances of Colours in the World are derived, not from any Phyſical Change cauſed in the Light by Refraction or Reflexion, but only from the various Mixtures or Separations of Rays, by virtue of their different Refrangibility or Reflexibility. And in this Reſpect the Science of Colours becomes a Speculation as truly Mathematical as any other Part of Opticks, ſo far as they depend upon the Nature of Light, and are not produced or altered by the Power of Imagination, or by ſtriking or preſſing the Edges.

Then in the following Part of the ſecond Book, he conſiders the Phænomena of the permanent Colours of Natural Bodies, and the Analogy between them and the Colours of thin tranſparent Plates: And having before ſhewn, *That Bodies appear of divers Colours, according as they are diſpoſed to reflect moſt copiouſly the Rays originally endued with theſe Colours*, he proceeds to examine their Conſtitutions, and to ſhew the Reaſon of their thus reflecting ſome Rays more copiouſly than others; which he doth in the following Propoſitions.

PROP. I.

Thoſe Superficies of tranſparent Bodies reflect the greateſt Quantity of Light which have the greateſt refracting Power; that is, *which intercede Mediums which differ moſt in their refractive Denſities; and in the Confines of equally refracting Mediums there is no Reflexion.*

PROP. II.

The leaſt Particles of almoſt all natural Bodies are, in ſome meaſure tranſparent, and the Opacity of thoſe Bodies ariſeth from the Multitude of Reflexions cauſed in their internal Parts.

PROP. III.

Between the Parts of opake and coloured Bodies are many Spaces, either empty, or repleniſhed with Mediums of other Denſities; as, Water between the tinging Corpuſcles with which any Liquor is impregnated; Air between the aqueous Globules that conſtitute Clouds or Miſts; and for the moſt part, Spaces void of both Air and Water, but yet perhaps not void of all Subſtance, between the Parts of hard Bodies.

PROP. IV.

The Parts of Bodies and their Interſtices, muſt not be leſs than of ſome definite Bigneſs, to render them coloured and opake.

PROP. V.

The tranſparent Parts of Bodies, according to their ſeveral Sizes, muſt reflect Rays of one Colour, and tranſmit thoſe of another, on the ſame Grounds that thin Plates or Bubbles do reflect or tranſmit thoſe Rays. And this I take to be the Ground of all Colours:

For if a thinned or plated Body, which being of an even Thickneſs, appears all over of an uniform Colour, ſhould be ſlipt into Threads, or broken into Fragments of the ſame Thickneſs with the Plate, I ſee no Reaſon why every Thread or Fragment ſhould not keep its Colour; and conſequently, why an Heap of thoſe Threads or Fragments ſhould not conſtitute a Maſs of Powder of the ſame Colour with the Plate exhibited before it was broken.

And the Parts of all natural Bodies being like ſo many Fragments of a Plate, muſt on the ſame Grounds exhibit the ſame Colours; and that they do ſo, will appear by the Affinity of their Properties. The finely coloured Feathers of ſome Birds, and particularly thoſe of Peacock's Tails, do in the very ſame Part of the Feather appear of ſeveral Colours in ſeveral Poſitions of the Eye, after the very ſame manner that thin Plates were found to do in the 7th and 19th Obſervations, and therefore ariſe from the Thinneſs of the tranſparent Parts of the Feathers; that is, from the Slenderneſs of the very fine Hairs, or *Capillamenta*, which grow out of the Sides of the groſſer lateral Branches or Fibres of thoſe Feathers. And to the ſame Purpoſe it is, that the Webs of ſome Spiders, by being ſpun very fine, have appeared coloured, as ſome have obſerved; and that the coloured Fibres of ſome Silks, by varying the Poſition of the Eye, do vary their Colour: Alſo the Colours of Silks, Cloaths, and other Subſtances, which Water or Oil can intimately penetrate, become more faint and obſcure by being immerged in thoſe Liquors, and recover

recover their Vigour again by drying, much after the manner of the thin Bodies mentioned in the 10th and 12th Obſervations. Leaf-Gold, ſome Sorts of painted Glaſs, the Infuſion of *Lignum Nephriticum*, and ſome other Subſtances, reflect one Colour and tranſmit another, like thin Bodies in the 9th and 20th Obſervations. And ſome of thoſe coloured Powders which Painters uſe, may have their Colours a little changed, by being very elaborately and finely ground; where I ſee not, what can be juſtly pretended for thoſe Changes, beſides the breaking of their Parts into leſs Parts, by that Contrition, after the ſame manner that the Colour of a thin Plate is changed by varying its Thickneſs: For which Reaſon alſo it is, that the coloured Flowers of Plants and Vegetables, by being bruiſed, uſually become more tranſparent than before, or at leaſt in ſome Degree or other change their Colours. Nor is it much leſs to this Purpoſe, that by mixing divers Liquors, very odd and remarkable Productions of Colours may be effected; of which no Cauſe can be more obvious and rational, than that the ſaline Corpuſcles of one Liquor do variouſly act upon or unite with the tinging Corpuſcles of another, ſo as to make them ſwell or ſhrink, (whereby not only their *Bulk*, but their *Denſity* alſo, may be changed); or to divide them into ſmaller Corpuſcles, (whereby a coloured Liquor may become tranſparent); or to make many of them aſſociate into one Cluſter, whereby two tranſparent Liquors may compoſe a coloured one. For we ſee how apt thoſe ſaline Menſtruums are to penetrate and diſſolve Subſtances to which they are applied, and ſome of them precipitate what others diſſolve.

In like manner, if we conſider the various Phænomena of the Atmoſphere, we may obſerve, that when Vapours are raiſed they hinder not the Tranſparency of the Air, being divided into Parts too ſmall to cauſe any Reflexion in their Superficies: But when, in order to compoſe Drops of Rain, they begin to coaleſce, and to conſtitute Globules of all intermediate Sizes, thoſe Globules, when they become of a convenient Size, to reflect ſome Colours and tranſmit others, may conſtitute Clouds of various Colours, according to their Sizes: And I ſee not what can be rationally conceived in ſo tranſparent a Subſtance as Water, for the Production of theſe Colours, beſides the various Sizes of its Fluid and Globular Particles.

Prop. VI.

The Parts of Bodies on which their Colours depend, are denſer than the Medium which pervades their Interſtices.

This appears by conſidering, that the Colour of a Body depends not only on the Rays which are incident perpendicularly on its Parts, but on thoſe alſo which are incident at all other Angles; and that, according to the 7th Obſervation, a very little Variation of Obliquity will change the reflected Colour, where the thin Body or ſmall Particle is rarer than the ambient Medium, inſomuch that ſuch a ſmall Particle will, at diverſly oblique Incidences, reflect all ſorts of Colours in ſo great a Variety, that the Colour reſulting from them all, confuſedly reflected from a Heap of ſuch Particles, muſt rather be White, or Grey, than any other Colour; or at beſt, it muſt be but a very imperfect and dirty Colour: Whereas if the thin Body, or ſmall Particle, be much denſer than the ambient Medium, the Colours, according to the 19th Obſervation, are ſo little changed by the Variation of Obliquity, that Rays which are reflected leaſt obliquely, may predominate over the reſt ſo much, as to cauſe a Heap of Particles to appear very intenſely of their Colour. It conduces alſo ſomething to confirm this Propoſition, that, according to the 22d Obſervation, the Colours exhibited by the denſer thin Body within the rarer, are more briſk than thoſe exhibited by the rarer within the more denſe.

Prop. VII.

The Bigneſs of the component Parts of Natural Bodies may be conjectured by their Colours.

For ſince the Parts of theſe Bodies (by *Prop.* 5.) do moſt properly exhibit the ſame Colours with a Plate of equal Thickneſs, provided they have the ſame refractive Denſity; and ſince their Parts ſeem for the moſt part to have much the ſame Denſity with Water or Glaſs, as by many Circumſtances is obvious to collect; to determine the Sizes of theſe Parts, you need only have Recourſe to the preceding Table, where the Thickneſs of Water or Glaſs exhibiting any Colour is expreſſed. Thus, if it were deſired to know the Diameter of a Corpuſcle, which being of equal Denſity with Glaſs, ſhall reflect Green of the third Order; (and what the Meaning of theſe Orders are, I have explained above, under Sir *Iſaac*'s 4th Obſervation). The Number in the Table will be $16\frac{1}{4}$, which ſhews it to be $\frac{16\frac{1}{4}}{100000}$ Part of an Inch. And from that 4th, and his 18th Obſervation, he gathers theſe Particulars:

1. That *Scarlets*, and other *Reds*, *Oranges*, and *Yellows*, if they be pure and intenſe, are moſt probably of the ſecond Order: Thoſe of the firſt and third alſo may be pretty good, only the Yellow of the firſt Order is faint, and the Orange and Red of the third Order have a great Mixture of Blue and Violet.

2. There may be good *Greens* of the fourth Order, but the pureſt are of the third; and of this Order the Green of all Vegetables ſeems to be, partly becauſe of the Intenſeneſs of their Colours, and alſo, that when they wither, ſome of them turn to a Greeniſh-yellow, others to a more perfect Yellow, or Orange, or perhaps to Red, paſſing firſt thro' all the aforeſaid intermediate Colours; which Changes ſeem to be effected by the exhaling of the Moiſture, which may leave the tinging Corpuſcles more denſe, and ſomething alſo augmented by the Accretion of the oily and earthy Part of that Moiſture. Now the Green is, without doubt, of the ſame Order with thoſe Colours into which it changes, becauſe the Changes are gradual; and theſe Colours, tho' uſually not very full, yet are often too full and lively, to be of the fourth Order.

3. *Blues* and *Purples* may be either of the ſecond or third Order, but the beſt are of the third. Thus the Colour of Violets ſeems to be of that Order, becauſe their Syrup, by acid Liquors, runs Red, and by Urinous and Alkalizate turns Green. For ſince 'tis the Nature of Acids to diſſolve and attenuate, and of Alkalies to precipitate and incraſſate; if the Purple Colour of the Syrup was of the ſecond Order, an acid Liquor, by attenuating its tinging Corpuſcles, would change to a Red of

the firſt Order; and an Alkali, by incraſſating them, would change it to a Green of the ſecond Order: Which Red and Green, eſpecially the Green, ſeem too imperfect to be the Colours produced by theſe Changes: But if the ſaid Purple be ſuppoſed to be of the third Order, its Change to Red of the ſecond, and Green of the third, may, without any Inconveniency, be allowed.

If there be any Body of a deeper and leſs Reddiſh-purple than that of Violets, 'tis probable its Colour is that of the ſecond Order.

The *Blue* of the firſt Order, tho' very faint and little, may poſſibly be the Colour of ſome Subſtances; and particularly, the Azure Colour of the Sky ſeems to be of this Order: For all Vapours, when they begin to condenſe and coaleſce into ſmall Parcels, become firſt of that Bigneſs whereby ſuch an Azure muſt be reflected, before they can conſtitute Clouds of other Colours: And ſo this being the firſt Colour which Vapours begin to reflect, it ought to be the Colour of the fineſt and moſt tranſparent Skies, in which Vapours are not arrived to that Groſſneſs requiſite to reflect other Colours, as we find it by Experience.

4. *Whiteneſs*, if moſt intenſe and luminous, is that of the firſt Order; if leſs ſtrong and luminous, 'tis a Mixture of the Colours of ſeveral Orders. Of this laſt kind he takes the Whiteneſs of Froth, Paper, Linen, and moſt white Subſtances, to be; and of the former, that of white Metals: For ſince the denſeſt of Metals (Gold) if foliated, is tranſparent, and that all Metals become tranſparent by being diſſolved in Menſtruums, or by being vitrified, the Opacity of white Metals ariſeth not from this Denſity alone; they being leſs denſe than Gold would be more tranſparent than it, did not ſome other Cauſe concur with their Denſity, to make them opake. And this Cauſe he takes to be ſuch a Bigneſs of their Particles as fits them to reflect the White of the firſt Order: For if they be of other Thickneſſes, they muſt reflect other Colours, as is manifeſt by the Colours which appear upon hot Steel in tempering it, and ſometimes upon the Surface of melted Metals in the Skin or Scoria which ariſes upon them in their cooling. And as the White of the firſt Order is ſtrongeſt which can be made by Plates of tranſparent Subſtances, ſo it ought to be ſtronger in the denſer Subſtances of Metals than in the rarer of Air, Water, and Glaſs: Nor doth he ſee but that Metallick Subſtances of *ſuch a Thickneſs* as may fit them to reflect the White of the firſt Order, may, by reaſon of their great Denſity, (according to *Prop.* 1.) reflect all the Light incident upon them, and ſo be as opake and ſplendent as 'tis poſſible for any Body to be. Gold or Copper, mixed with leſs than $\frac{1}{2}$ their Weight of Silver, Tin, or Regulus of Antimony, either in Fuſion, or amalgamated with a very little Mercury, become *white*, which ſhews both that the Particles of white Metals have much more Superficies, and ſo are *ſmaller* than thoſe of Gold and Copper; and alſo, that they are ſo opake as not to ſuffer the Particles of Gold or Copper to ſhine thro' them: Nor is it to be doubted but that the Colours of Gold and Copper are of the ſecond Order, or of the third; and therefore the Particles of white Metals cannot be much bigger than is requiſite to make them reflect the White of the firſt Order. The Volatility of Mercury argues that they are not much *bigger*, nor may they be much *leſs*, leſt they loſe their Opacity, and become either *tranſparent*, as they do when attenuated by Vitrification, or by Solution in Menſtruums; or *black*, as they do when ground ſmaller, by rubbing Silver, Tin, or Lead, on other Subſtances, to draw black Lines. The firſt and only Colour which white Metals take by grinding their Particles ſmaller, is *Black*; and therefore their *White* ought to be that which borders upon the black Spot in the Centre of the Rings of Colours mentioned in the preceeding Obſervation; that is, the White of the firſt Order: But if you would hence gather the Bigneſs of Metallick Particles, you muſt allow for their Denſity: For were Mercury tranſparent, its Denſity is ſuch, that the Sine of Incidence upon it (by Sir *Iſaac Newton*'s Computation) would be to the Sine of Refracting as 71 to 30, or as 7 to 2: And therefore the Thickneſs of its Particles, that they may exhibit the ſame Colours with thoſe of Bubbles of Water, ought to be leſs than the Thickneſs of the Skin of thoſe Bubbles in the Ratio of 2 to 7.

Whence 'tis poſſible, that the Particles may be as little as the Particles of ſome tranſparent and volatile Fluids, and yet reflect the White of the firſt Order.

5. For the Production of *Blackneſs*, he ſhews, That the Corpuſcles muſt be leſs than any of thoſe which exhibit any other Colours; becauſe at all greater Sizes of Particles there is too much Light reflected to conſtitute this Colour: But if they be ſuppoſed a little leſs than is requiſite to reflect the White and very faint Blue of the firſt Order, they will (according to *Obſervation* 4, 8, 17, and 18.) reflect ſo very little as to appear intenſely black, and yet may perhaps variouſly refract it to and fro within themſelves ſo long, until it happen to be ſtifled and loſt, by which means they will appear black in all Poſitions of the Eye, without any Tranſparence: And from hence may be underſtood why *Fire*, and that more ſubtile Diſſolver *Putrefaction*, by dividing the Particles of Subſtances, turn them to black; why ſmall Quantities of black Subſtances impart their Colour very freely and intenſely to other Subſtances to which they are applied, the minute Particles of theſe, by reaſon of their very great Number, eaſily overſpreading the groſs Particles of others; why Glaſs ground very elaborately with Sand on a Copper-plate, till it be well poliſhed, makes the Sand, together with what is worn off from the Glaſs and Copper, become very black; why black Subſtances do, ſooneſt of all others, become hot in the Sun's Light, and burn, (which Effect may proceed partly from the Multitude of Refractions in a little Room, and partly from the eaſy Commotion of ſo very ſmall Particles); and why Blacks are uſually inclined a little to a bluiſh Colour; for that they are ſo, may be ſeen by illuminating white Paper by Light reflected from black Subſtances, when the Paper will uſually appear of a Blueiſh-white; and the Reaſon is, becauſe Black borders on the obſcure Blue of the firſt Order in the 18th Obſervation, and therefore reflects more Rays of that Colour than any other.

The *Senſations of different Colours* ſeem to ariſe from hence, That ſeveral Sorts of Rays do make Vibrations of ſeveral Bigneſſes, which, according to their Magnitudes, do excite Senſations of ſeveral Colours, much after the Manner that the Vibrations of the Air, according to their ſeveral Bigneſſes, do excite Senſations of different Sounds: And, in particular, 'tis probable, that the moſt refrangible Rays excite the ſhorteſt Vibrations, and ſo produce the Senſation of a deep Violet Colour; and that the leaſt refrangible Rays excite the largeſt Vibrations, and ſo produce the Senſation of a deep Red ; and that the ſeveral intermediate Sorts of Rays do excite Vibrations of ſeveral intermediate Bigneſſes, and thereby produce the Senſations of the ſeveral intermediate Colours.

And 'tis probable alſo, that the Harmony and Diſcord of Colours (for ſome Colours, as that of Gold, Yellow, and Indico, are agreeable to the Eyes, and ſome not) ariſe from the Proportions of theſe Vibrations propagated thro' the Fibres of the Optick Nerves into the Brain, juſt as the Harmony and Diſcord of Sounds ariſes from the Vibrations of the Air. See *Newton*'s *Opticks*, at the End.

He ſhews alſo there, at the 21ſt Query, That to the Production of all the Varieties of Colours, and the various Degrees of Refrangibility of the Rays of Light, there is nothing more neceſſary, than that the Rays of Light be ſmall Bodies or Particles of different Magnitudes ; the leaſt Size of which conſtitute a deep Violet Colour, as being the moſt dark and languid of all others, and as being moſt turned out of their Way by the Action of refracting Surfaces upon them : And the other Sizes of the Rays of Light, according as they increaſe in Magnitude, do exhibit ſtronger and brighter Colours, as Blue, Green, Yellow, and Red, and are, in Proportion to their Bigneſs, leſs and leſs capable of being refracted, or turned out of their Way.

Colour may be conſidered two Ways. 1. As it is a Quality reſiding in the Body that is ſaid to be ſo and ſo coloured, or which doth modify the Light after ſuch and ſuch a manner. Or,

2. As more properly the Light itſelf, which ſo modified, ſtrikes upon the Organ of Sight, and produces that Senſation which we call *Colour*.

The *Peripateticks* aſſert *Colours* to be real Qualities, and inherent in the coloured Bodies, and ſuppoſe that Light doth only diſcover them, but not any way effect their Production.

Plato thought *Colour* to be a kind of Flame conſiſting of moſt minute Particles, very congruous to the Pores of the Eye, and darted againſt it from the Object : And ſome Moderns will have *Colour* to be a kind of internal Light of the more lucid Parts of the Object darkened, and conſequently altered by the various Mixtures of the leſs luminous Parts.

Others, as did ſome of the ancient Anatomiſts, maintain *Colour* not to be a lucid Stream, but a corporeal Effluvium iſſuing out of the coloured Body.

Others account for all *Colours* out of the various Mixture of Light and Darkneſs ; and the Chymiſts ſometimes will have it ariſe from the Sulphur, and ſometimes from the Salt, that is in Bodies ; and ſome alſo from the third Hypoſtatick Principle, *Mercury*.

The *Carteſians*, who make the Senſation of Light to be the Impulſe made on the Eye, by certain ſolid, but very minute Globules, eaſily permeateing the Pores of the Air and Diaphanous Bodies : Theſe, I ſay, derive *Colour* from the various Proportion of the direct Progreſs or Motion of theſe Globules, to their Circumrotation or Motion round their own Centres ; by which means they are qualified to ſtrike the Optick Nerve after diſtinct and divers Manners, and ſo do produce the Perception of various *Colours*.

Dr. *Hook*, in his *Micrographia*, ſays, The Phantaſm of *Colour* is cauſed by the Senſation of the oblique or uneven Pulſe of Light, and that this is capable of no more Varieties than two, which ariſe from the two Sides of the oblique Pulſe ; ſo that there are in reality but two ſimple *Colours*, that is, *Yellow* and *Blue* ; and from the Mixture of which, and a due Proportion of Black and White (that is, *Darkneſs* and *Light*) all *Colours* may be produced.

The incomparable Sir *Iſaac Newton* found, by two Experiments on Priſms, that there is a great Difformity in the Rays of Light, and that hereby the *Origin of Colours* may be unfolded. The Doctrine therefore of *Colours*, according to his Notion and Experiments, are contained in the following Propoſitions.

1. As the Rays of Light differ in Degrees of Refrangibility, ſo they alſo differ in their Diſpoſition, to exhibit this or that particular *Colour*.

Colours are not Qualifications of Light derived from Refractions or Reflexions of Natural Bodies (as 'tis generally believed) but Original and Connate Properties, which in divers Rays are divers. Some Rays are diſpoſed to exhibit a Red *Colour*, and no other ; ſome a Yellow, and no other ; ſome a Green, and no other ; and ſo the reſt : Nor are there only Rays proper and particular to the more eminent *Colours*, but even to all their intermediate Gradations.

2. To the ſame Degree of Refrangibility ever belongs the ſame *Colour*, and to the ſame *Colour* ever belongs the ſame Degree of Refrangibility. The leaſt refrangible Rays are all diſpoſed to exhibit a Red *Colour* ; and contrarily, thoſe Rays which are diſpoſed to exhibit a Red Colour, are all the leaſt refrangible : So the moſt refrangible Rays are all diſpoſed to exhibit a deep Violet *Colour* ; and contrarily, thoſe that are apt to exhibit ſuch a Violet *Colour*, are all the moſt refrangible : And ſo all the intermediate *Colours*, in a continued Series, belong to intermediate Degrees of Refrangibility. And this Analogy 'twixt *Colours* and Refrangibility is very preciſe and ſtrict ; the Rays always either exactly agreeing in both, or proportionably diſagreeing in both.

3. The Species of *Colour*, and Degree of Refrangibility, proper to any particular Sort of Rays, is not mutable by Refraction, nor by Reflexion, from Natural Bodies, nor any other Cauſe that could be yet obſerved ; when any ſort of Rays hath been well parted from thoſe of other Kinds, it afterwards obſtinately retained its *Colour*, notwithſtanding all Endeavours to change it ; tho' refracted with Priſms, and reflected with Bodies, which in Day-light were of other *Colours* ; having alſo intercepted it with the coloured Film of Air, intercedeing two compreſſed Plates of Glaſs, tranſmitting it thro' other coloured Mediums, and thro' Mediums radiated with other ſorts of Rays, and diverſly terminated it, and yet could never produce any new *Colour* out of it. It would, by contracting or dilating, become more briſk or faint, and by the Loſs of many Rays, in ſome Caſes, very obſcure and dark, but could never be ſeen to change in Specie.

4. Yet a ſeeming Tranſmutation of *Colours* may be made where there is any Mixture of divers ſorts of Rays ; for in ſuch Mixtures the Component *Colours* appear not, but by their mutually allaying each other, conſtitute a middling *Colour* ; and therefore, if by Refraction, or any other of the aforeſaid Cauſes, the difform Rays, latent in ſuch a Mixture, be ſeparated, there ſhall emerge *Colours* different from the *Colour* of the Compoſition ; which *Colours* are not now generated, but only made apparent, by being parted ; for if they be again entirely mix'd and blended together, they

will again compoſe that *Colour* which they did before Separation. And for the ſame Reaſon, Tranſmutation made by the convening of divers *Colours*, are not real; for when the diſform Rays are again ſevered, they will exhibit the very ſame *Colours*, which they did before they entered the Compoſition; as you ſee *Blue* and *Yellow* Powders, when finely mixt, appear to the naked Eye *Green*; and yet the *Colours* of the component Corpuſcles are not thereby really tranſmuted, but only blended; for when viewed with a good Microſcope, they ſtill appear *Blue* and *Yellow* interſperſedly.

5. There are therefore two ſorts of *Colours*, the one original and ſimple; the other compounded of theſe. The original and primary *Colours* are, *Red*, *Yellow*, *Green*, *Blue*, and a *Violet Purple*, together with *Orange*, *Indico*, and an indefinite Variety of intermediate Gradations.

6. The ſame *Colours* in *Specie* with theſe primary ones, may be alſo produced by Compoſition; for a Mixture of *Yellow* and *Blue*, makes *Green*; of *Red* and *Yellow*, makes *Orange*; of *Orange* and *Yellowiſh Green*, makes *Yellow*: And in general, if any two *Colours* be mixed, which in the Series of thoſe generated by the Priſm, are not too far diſtant one from another, they, by their mutual Alloy, compound that *Colour* which in the ſaid Series appeareth in the Mid-way between them; but thoſe which are ſituated at too great a Diſtance, do not ſo; *Orange* and *Indico* produce not the intermediate *Green*; nor *Scarlet* and *Green*, the intermediate *Yellow*.

7. But the moſt ſurpriſing and wonderful Compoſition was that of *Whiteneſs*. There is no one ſort of Rays alone which can exhibit this: 'Tis ever compounded, and to its Compoſition are requiſite all the aforeſaid primary *Colours* mixed in a due Proportion; for all the *Colours*, of the Priſm being made to converge, and thereby to be again mixed as they were in the Light before it was incident upon the Priſm, will produce Light entirely and perfectly *White*, and not at all ſenſibly differing from a *direct Light of the Sun*, unleſs when the Glaſſes are not ſufficiently clear.

8. Hence therefore it comes to paſs, that *Whiteneſs* is the uſual *Colour* of *Light*; for *Light is a confuſed Aggregate of Rays indued with all ſorts of* Colours, *as they are promiſcuouſly darted from the various Parts of luminous Bodies*: And of ſuch a confuſed Aggregate is generated *Whiteneſs*, if there be a due Proportion of the Ingredients; but if any one predominate, the Light muſt incline to that *Colour*, as it happens in the *Blue* Flame of Brimſtone, the *Yellow* Flame of a Candle, and the various *Colours* of the fixed Stars.

9. Theſe things conſidered, the Manner how *Colours* are produced by the Priſm is evident: For the Rays conſtituting the incident Light, ſince thoſe that differ in *Colour*, proportionably differ in Refrangibility, they, by their unequal Refractions, muſt be ſevered and diſperſed into an oblong Form, in an orderly Succeſſion from the leaſt refracted *Scarlet* to the moſt refracted *Violet*. And for the ſame Reaſon it is, that Objects, when look'd upon thro' a Priſm, appear coloured: For the diſform Rays, by their unequal Refractions, are made to diverge towards ſeveral Parts of the *Retina*, and there expreſs the Images of things coloured, as they do the Sun's Image upon a Wall: And by this Inequality of Refractions, they become not only coloured, but alſo very confuſed and indiſtinct.

10. Why the *Colours* of the Rainbow appear in falling Drops of Rain, is alſo from hence evident; for thoſe Drops which refract the Rays diſpoſed to appear Purple in greateſt Quantity to the Spectator's Eye, refract the Rays of other ſorts ſo much leſs, as to make them paſs beſide it; and ſuch are the Drops on the Inſide of the primary Bow, and on the Outſide of the ſecondary or exterior one: So theſe Drops which refract in greateſt Plenty the Rays apt to appear *Red* towards the Spectator's Eye, refract thoſe of other ſorts ſo much more, as to make them paſs beſide it; and ſuch are the Drops on the exterior Part of the primary, and interior Part of the ſecondary Bow.

11. The odd Phænomenon of an Infuſion of *Lignum Nephriticum*, *Leaf-Gold*, *Fragments of coloured Glaſs*, and ſome other tranſparently coloured Bodies appearing in one Poſition of one Colour, and of another in another, are, on theſe Grounds, no longer Riddles; for thoſe are Subſtances apt to reflect one ſort of Light, and tranſmit another, as may be ſeen in a dark Room, by illuminating them with ſimilar or uncompounded Light: For then they appear of that *Colour* only with which they are illuminated, but yet in one Poſition more vivid and luminous than in another, accordingly as they are diſpoſed more or leſs to reflect or tranſmit the incident *Colour*.

12. From whence alſo is manifeſt the Reaſon of an unexpected Experiment, which Dr. *Hook* in his *Micrography*, relates to have made with two Wedge-like tranſparent Veſſels, filled the one with a *Red*, the other with a *Blue* Liquor; namely, that tho' they were ſeverally tranſparent enough, yet both together became opake; for if one tranſmitted only *Red*, and the other only *Blue*, no Rays could paſs thro' both.

13. That the *Colours* of all natural Bodies have no other Origin than this, that they are variouſly qualified to reflect one ſort of Light in greater Plenty than another: And this was experimented in a dark Room, by illuminating thoſe Bodies with uncompounded Light of divers *Colours*; for by that means any Body may be made to appear of any *Colour*: They have there no appropriate *Colour*, but ever appear of the *Colour* of the Light caſt upon them; but yet with this Difference, that they are more briſk and vivid in the Light of their own Day-light *Colour*. *Minium* appeareth there of any *Colour* indifferently with which it is illuſtrated, but yet moſt luminous in *Red*: And ſo *Biſe* appeareth indifferently of any *Colour* with which 'tis illuſtrated, but yet moſt luminous in *Blue*; and therefore *Minium* reflecteth Rays of any *Colour*, but moſt copiouſly thoſe indued with *Red*; and conſequently, when illuſtrated with Day-light, that is, with all ſorts of Rays promiſcuouſly blended, thoſe qualified with *Red* ſhall abound moſt in the reflected Light, and by their Prevalence, cauſe it to appear of that *Colour*: And for the ſame Reaſon, *Biſe* reflecting *Blue* moſt copiouſly, ſhall appear *Blue* by the Exceſs of thoſe Rays in its reflected Light; and the like of other Bodies. And that this is the entire and adequate Cauſe of their Colours is manifeſt, becauſe they have no Power to change or alter in the Colours of any ſort of Rays incident apart, but put on all *Colours* indifferently with which they are enlightened.

Theſe things being ſo, it can be no longer diſputed, whether there be *Colours* in the Dark? Nor whether they be the Qualities of the Objects we ſee? No nor, perhaps, whether Light be a Body? For ſince *Colours* are the Qualities of Light, having its Rays for their entire and immediate Subject, how can we think thoſe Rays Qualities alſo, unleſs one Quality may be the Subject of, and ſuſtain another; which, in effect, is to call it *Subſtance?* We ſhould not know Bodies from Subſtances, were it not for their ſenſible Qualities; and the Principal of thoſe being now found due to ſomething elſe, we have as good Reaſon to believe that to be a Subſtance alſo.

Thus far went this wonderful Man, as long ſince as the Year 1675, as you may ſee more at large in the *Philoſoph. Tranſactions*, N. And as himſelf acquaints us, with his uſual Modeſty, in his excellent Treatiſe of *Opticks*, juſt now publiſhed, and come to my Hands while this Part was compoſing at the Preſs, where the Reader will meet with ample Satisfaction, as to all Parts of the admirable *Doctrine of Light and Colours.* And that the World may ſee, that the Account he ſo long ago publiſhed of this Theory, was both intelligible, and certainly true, I have ſubjoined the ſubſequent Experiments, which came to my Hands a Year ago, and are inſerted here alſo at the Deſire of their Author, the ingenious Mr. *John Perks* of *Old-ſwinford* in *Worcheſter-ſhire.*

An Abſtract of Sir Iſaac Newton's *Doctrine concerning* Light *and* Colours.

1. Light conſiſts of an infinite Number of Rays, right-lined and parallel; but of different Degrees of Refrangibility, when meeting with a different Medium.

2. Each Ray, according to its Degree of Refrangibility, when ſo refracted, appears to the Eye, of a different Colour.

3. The leaſt refrangible Rays appear of a deep Scarlet, the moſt refrangible appear of a violet Blue, the intermediate proceeding from Scarlet to Yellowiſh, then to Light-Green, and ſo to Blue.

4. The Colours ariſing from the different Refrangibility of Light, are not only the more noted Colours of Red, Yellow, Green, and Blue, but alſo all the intermediate Degrees of Red to Yellow, of Yellow to Green, &c. differing as the Degrees of Sound from Grave to Acute, in which there are not only the Notes of common Denomination, but alſo indefinite intermediate Degrees of Sounds, which are diſtinct different Sounds, as the other.

5. Whiteneſs (ſuch as the Sun's Light appears) containing all theſe Degrees of Refrangibility, is conſequently made up of all the above mentioned Colours.

6. Simple or homogeneal Colours are ſuch as are produced by homogeneal Lights or Rays, that have the ſame Degree of Refrangibility, and mix'd Colours are ſuch as are produced by Rays of different Refrangibility.

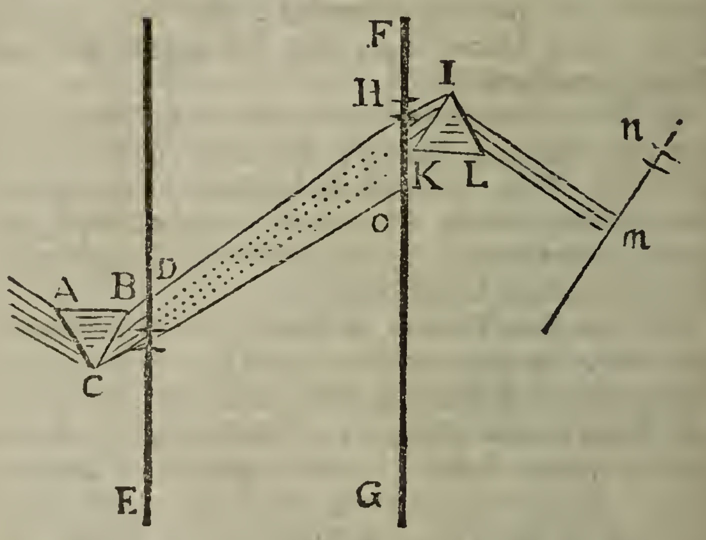
7. Rays of the ſame Refrangibility produce the ſame Colour, which Colour is not alterable by repeated Refractions, only made more ſtrong or faint, as the Rays are united or ſcattered.

8. All Bodies appear of this or that Colour, according as the Surfaces are adapted to reflect only the Rays of ſuch a Colour, or (at leaſt) in more Plenty than the reſt.

Experiments, for Confirmation of the foregoing Doctrine.

Experiment I.

The great Experiment on which Sir *Iſaac Newton* grounds his Doctrine (and which he calls *Experimentum Crucis*) is after this manner: B E and F G are two Boards about four or five Yards Diſtance, having in each of them a little round Hole at D and H, about one Fourth of an Inch Diameter. A B C is a Priſm expoſed to the Sun, I K L is another Priſm, whoſe Side I K is near parallel to the Side B C of the other, and receiving the Rays D H, refracts them to fall on a Paper *n m.*



The Colours will fall from H to O, on the Board F G: Let one only Colour (ſuppoſe Blue) fall on the Hole H, and it will be refracted by the Priſm I K L, to fall (ſuppoſe) at M; then move the Glaſs A B C about its Axis, ſo as to bring another Colour (ſuppoſe the Red at O) to the Hole H, and it will, by the Glaſs I K L, be refracted, not to M, but another Place (ſuppoſe N) ſome Diſtance from the other; and in like manner will each Colour be refracted to fall on a different Place, tho' the Glaſs I K L be held unmoved. This Experiment proves the different Refrangibility of the Rays of Light, and that different Colours do thence ariſe.

For the Holes D and H being fixed, and alſo the Glaſs I K L, 'tis plain, that the Rays have a like Incidence on the Glaſs I K L but the different Places where they fall on the Paper, as M, N, &c. ſhew a different Refraction in the Glaſs I K L; and the Eye diſcovers a different Colour, according to the different Places on which the Rays fall, which demonſtrates the fundamental Doctrine of the Theory.

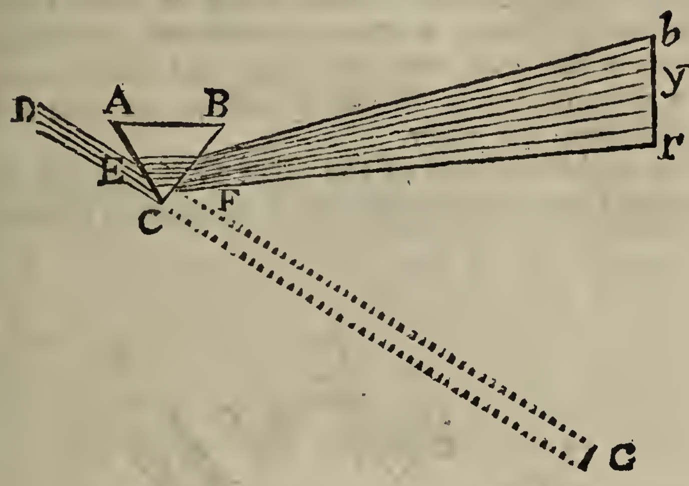
Sir *Iſaac Newton* directs this to be done in a dark Room, where (no doubt) all will appear more exact and lively. My Trial (for want of Conveniencies) was in an open Room, but it ſucceeded well enough to ſatisfy me of the Truth.

He obſerves, that the oblong Image of Colours H O, will be about five times its Breadth, which alſo ſhews the different Refrangibility of the Rays, which otherwiſe would be near as round as the Hole D is.

Experiment II.

Being in a convenient Room, where the Sun ſhines thro' a Hole or open Caſement, turn your Back towards the Sun, and hold the one End of the Priſm ſo to your Eye, that the Sun may ſhine on the other End; then move it ſo about its Axis, that the Colours may appear ſomewhere on the Wall, find the Colours with your Eye looking thro' the other End of the Glaſs, and there will appear a Spot of perfect Light.

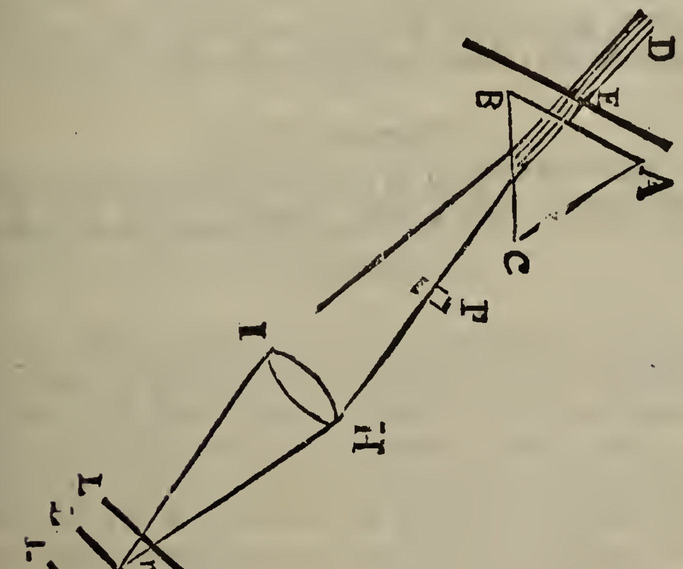
The Reaſon of this Appearance is this: The parallel Rays D E, meeting with the Glaſs at E, and again with the Air at F, are ſeparated by theſe two Refractions, the leaſt refrangible appear Red at *r*, and the moſt refrangible appear Blue at *b*,



with the intermediate Colours between. Theſe Colours being viewed by the Eye at E, the Rays come back (near) the ſame way they went, and are therefore, in like manner united at the Eye, as they were in their Incidence from the Sun, and conſequently have the ſame Appearance (White) as the Light itſelf. The Place where the Spot of Light appears to the Eye, is at G, where the Rays would have fallen, had they not been intercepted, and of a Bigneſs according to what Light falls on the Glaſs; whereas the coloured Image *b y r* will appear four or five times longer, by reaſon of the ſcattering of the differently refracted Ray.

Experiment III.

A B C is the Priſm, upon one of whoſe Sides is put a Paſtboard or thick Paper A B, or the like,



with a little round Hole at E, which being expoſed to the Sun's Rays D E, they are refracted and carried (in Colours) towards H I.

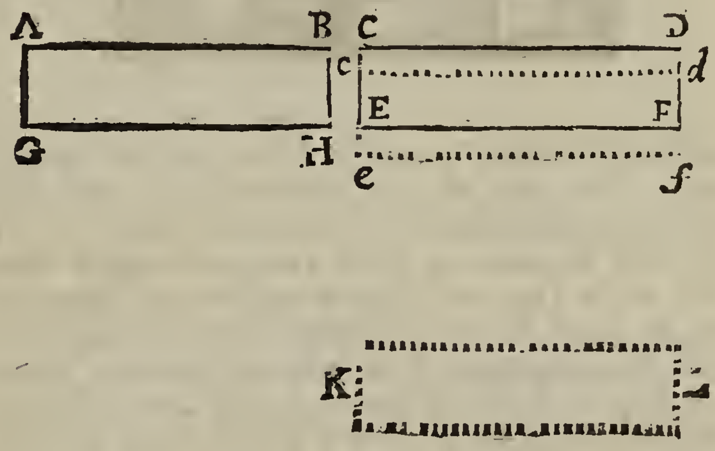
H I is a Lens (or a common Magnifying-Glaſs) broad enough to receive all the coloured Rays, where, they being made to converge by the Glaſs, they will be united in O, the Focus of the Glaſs.

Hold a Piece of Paper K L in the Focus, where all the Colours are united, and the little Spot at O will be perfect Light or Whiteneſs; but if the Paper K L be held further or nearer off (as at M or N) the Colours will appear. If any Colours be intercepted, as at P, the Light near O will not be clear White, but inclining to the remaining Colours. If the Blue be wanting, the White will be ſomewhat Reddiſh or Fleſh-Colour; and if the Red be wanting, the White will incline to be ſomething Blueiſh; and if only one Colour be let come to the Lens, that Colour, without Alteration, will be transferred to the Paper K L.

This Experiment ſhews, 1. That all the Colours being united, make Light or Whiteneſs. 2. That if any original Colour be wanting, the White will not be pure. 3. That a ſimple Colour is not alterable by farther Refractions; which alſo will appear if another Priſm be put at O.

Experiment IV.

Let A B G H be a Piece of fine Silk of a lively Scarlet-Colour, whoſe Edges, A B and G H, are

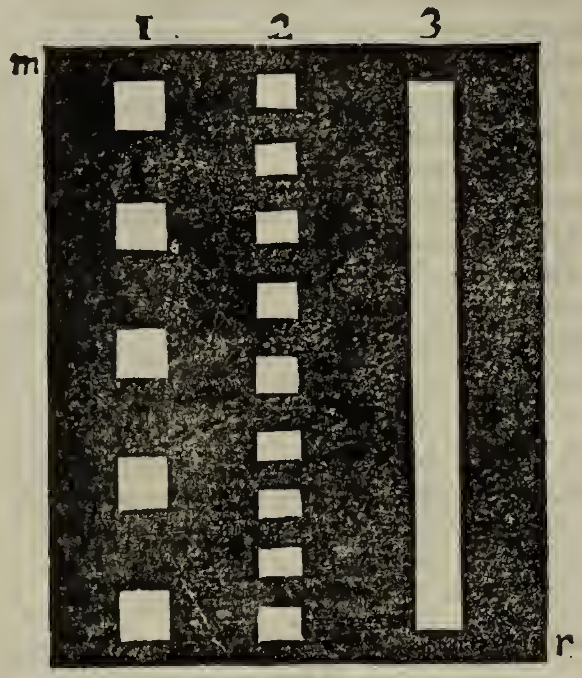


ſtreight, parallel, and ſmooth: Let C D E F be another Piece, of Violet-Blue Silk, like and equal to the other. Let them be placed, as in the Figure, on ſome black Cloth or Door, with their Edges in a ſtreight Line. View them thro' a Priſm at about two or three Yards Diſtance: The Axis of the Priſm being parallel to the Poſition of the Silks: So will the blue Piece C F appear lower than the other; *viz.* as in *c d e f*. The Reaſon of which Appearance is, that Blue is more refrangible than Red.

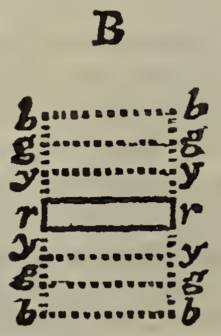
> *This will more fully appear, if, inſtead of the Blue Silk* C F, *there be let fall in the Place of* C F, *the Blue Rays from another Priſm, (the other Colours being intercepted by a Paper with a ſquare Hole for the Blue to paſs thro'). If the Silk* A H, *and the Blue Square* C F, *be viewed thro' a Priſm (as before) the Blue will appear far below, as at* K L; *this being a more perfect Blue than any Silk can be of.*

Experiment V.

Let M N be the black Cover of a Book, Paper coloured Black, or the like; upon which lay in a ſtreight Line, five or ſix little Squares of white Paper, about the Bigneſs, and at the Diſtance, as in the Figure, firſt Column: View theſe thro' a Priſm, ſo as that the Row of little Squares have its one End towards you, or be in a Plain perpendicular to the Axis of the Priſm, and about two Foot diſtant from the Glaſs; ſo will you ſee a Stream of Colours proceeding from every Square, towards the next nearer you, the Colours ariſing out of each white Square. Move theſe Squares near to one another, or put others between them, as in the ſecond Column (ſtill keeping them in a ſtreight Line) and you will ſee as they come near, that the Colours mixing one with another, will alter, approaching nearer to White till the Squares touch, and then all the Colours being perfectly mix'd, they produce Whiteneſs, and appear as in the third Column, a white Line, only tagg'd with Red at the Top, and Blue at the Bottom, there being no other Colours coming from above to mix with the uppermoſt Red, nor any Colours below the Blue, at Bottom, for it to mix with. If you turn the Paper M N aſide a little from its Perpendicularity to the Glaſs, the third Column, which before appeared White, will all appear in Colours ariſing out of the White, and ſtreaming towards you, being always in a Plane perpendicular to the Axis of the Priſm.



From this Experiment, and the foregoing Doctrine, we have the Reaſon why a Sheet of white Paper, or the like, appears coloured only at the Edges, for there only the Colours want others to mix with them. In the Middle, taking any Point, the ſeveral Colours, from ſo many other Points, meet there, as make White. For Inſtance:

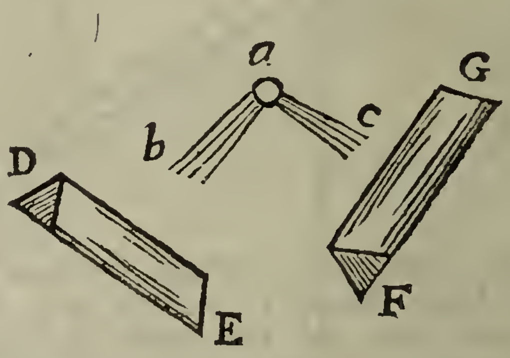


Let *r r* be any little Particle in the Middle of the white Surface, whoſe other Colours ſtreaming towards B, leave the Particle *r r* itſelf Red, as the Squares will do in the leaſt Experiment. The Yellow, of the Particle *y y*; the Green, of the Particle *g g*; the Blue, of the Particle *b b*; do all meet on the Particle *r r*, which is Red.

(For if *b b* were a white Particle, and all black about it, its blue Colour would be ſeen upon *r r*; and if *g g* were another, its Blue would be below *r r*, and its Green upon it, *&c.*) and ſo there being a Concurrence of all the Colours that make up White, it conſequently appears White. The ſame is to be ſaid of any other Particle lying ſo far from the Edges, as to have other Particles between to tranſmit their Colours.

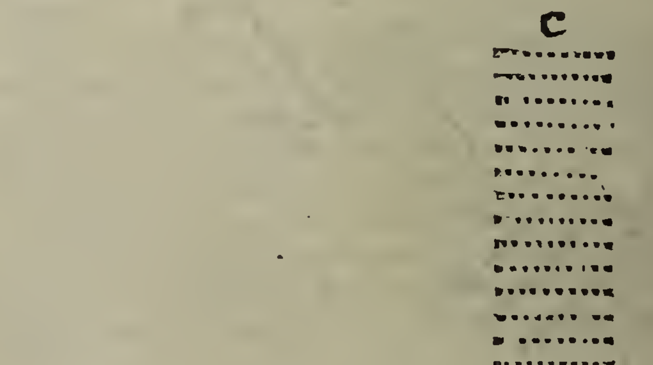
If a ſquare Paper be held ſo ſtreight before you, that the two Side Edges be in a Plane perpendicular to the Axis of the Glaſs, they will be White, and no Colours appear but at the Top and Bottom, the ſtreaming of the Colours being in ſuch a perpendicular Plane; as may be obſerved, by looking at any white Spot thro' the Glaſs, and then turning it a little obliquely to the Horizon, or one End higher than the other.

So in the Poſition of the Glaſs D E (ſee the following Figure) the white Spot aſcends its Colours towards *b*; and in the Poſition F G, the Colours ſtream from *a* to *c*. If a black Spot, as A, upon a Paper, be viewed thro' the Priſm, the Top will have Green and Blue upon it, and under the lower Part will appear Red and Yellow: The Reaſon of which is, that the Blue comes from the White above it, and appears on the Black, there being no other Colours to mix with it. The Red appears under the Spot, becauſe the black Spot tranſmits no other Colours to mix with the Red.



Experiment VI.

Hold the Priſm ſo to the Sun, as that the Colours may appear upon a large plain Wall, as at A B; turn the Priſm ſwiftly about its Axis, ſo as that the Colours may move ſwiftly up and down, as from B to C.



So will there appear no Colour diſtinct, but a faint white Streak between B and C, which ſo appears, becauſe (by the Swiftneſs of the Motion) the ſeveral Colours are confounded and mix'd, and therefore appear White; then move the Glaſs in ſuch manner, that the Colours may move Sideways, and ſwiftly, from B to D; in which Caſe the Colours will not diſappear, but make a ſort of Liſt of ſeveral Colours, becauſe they are not mix'd to make Whiteneſs, but each Colour keep in its own Line.

Experiment VII.

In a dark Room, having a little Hole for the Sun's Rays to come in, apply the Priſm to the Hole, ſo as that the Colours may appear on a Wall. Hold a Quantity of Smalt, or Powder-Blue, or Blue Silk, in the Colour ſeverally, and it will appear clear, of the Colour of the Rays that fall on it, *viz.* Red while the Red-light falls upon it, and Yellow when the Yellow-light falls on it; but of all the Colours, it will moſt ſtrongly reflect the Blue, the Surface being moſt diſpoſed to reflect thoſe Rays, *&c.*

Then view a Quantity of Vermilion, or a little Piece of Scarlet-Silk in Blue-light, and 'twill appear Blue, and Green in the Green-light; but of all the Colours, 'twill moſt ſtrongly reflect the Scarlet Rays, and appear deepeſt of that Colour. This Experiment confirms the 8th Propoſition, That Bodies appear of the Colour of thoſe Rays that are moſt plentifully reflected from the Body to the Eye. Thus far Mr. *Perks.*

I can now only give you ſome of the *Propoſitions* of Sir *Iſaac Newton*'s excellent Book of *Opticks*, relating to the Doctrine of *Light* and *Colours*, with ſomething from him by way of Proof and Illuſtration, in the moſt eminent and material Points.

PROP. I.

Lights which differ in Colour, differ alſo in Degrees of Refrangibility.

PROP. II.

The Light of the Sun conſiſts of Rays differently refrangible.

PROP. III.

The Sun's Light conſiſts of Rays differing in Reflexibility; and thoſe Rays are more reflexible, which are more refrangible, than others.

This, which ſeems to be a ſurpriſing Property of Light, not before diſcovered, he proves in his 9th and 10th Experiments of the firſt Book, where 'tis evident, that the Rays within a Priſm, and refracted by its Baſe at their going out into the Air, being, by the Revolution of the Priſm round its Axis, made ſo oblique to the Baſe, as thereby to begin to be totally reflected by it. Then he ſhews, that theſe Rays become firſt of all totally reflected, which before, at equal Incidences with the reſt, had ſuffered the greateſt Refraction: And the ſame thing he found to happen alſo, when the Reflection was made by the common Baſe of two Priſms placed ſo together as to make a Parallelopiped, as in the 10th *Experiment.*

PROP. IV.

Probl. I.

To ſeparate from one another the Homogeneal Rays of Compound Light.

PROP. V.

Homogeneal Light is refracted regularly, without any Dilatation, Splitting, or Shattering, of the Rays; and the confuſed Viſion of Objects, ſeen through refracted Bodies by Heterogeneal Light, ariſes from the different Refrangibility of ſeveral ſorts of Rays.

This he proves in his 5th, 12th, 13th, and 14th *Experiments*; from whence it appears, that the croſs Poſition of a ſecond Priſm, to refract the Light of the Sun which came to it from a former Priſm, placed at the ſmall Hole of a darkened Room, did not at all dilate the *Image* or *Coloured Spectrum*, as to Breadth, nor increaſe its Dimenſions that way: As alſo, that homogeneal Light refracted by a Priſm, did not exhibit an oblong coloured Image, as heterogeneal Light doth, but that a round Spot of it was, by the Priſm, refracted exactly in the ſame Figure, and of the ſame Colour it was before the new Refraction; and moreover, that Flies, and ſuch like ſmall Objects, placed in homogeneal Light, and viewed thro' a Priſm, were not thereby at all rendered confuſed and indiſtinct, as to Appearance; whereas, if placed in heterogeneal Light, and viewed after the ſame manner, they ſeemed egregiouſly confuſed.

BOOK II.

PROP. I.

The Phænomena of Colours, in reflected or refracted Light, are not cauſed by new Modifications of the Light variouſly impreſt, according to the various Terminations of the Light and Shadow.

For by the 10th Experiment (*Book* I.) 'tis evident, that the Sun's Light being tranſmitted into a dark Room, thro' the parallel Surface of two Priſms faſtened together in the Form of a Parallelopiped, became totally of one Colour, either uniformly Yellow or Red, at its emerging out of the Priſm. In the Production of which Colour, the Confine of Shadows (he ſhews) can have nothing to do; becauſe the Light changes from White, to Yellow, Orange, and Red, ſucceſſively, without any Alteration of the Confine of Shadow. At both Edges of the emerging Light, where the contrary Confines of Shadow ought to produce different Effects, the Colour is one and the ſame, whether it be White, Yellow, Orange, or Red; and in the Middle of the emerging Light, where there is no Confine of Shadow at all, the Colour is the very ſame as at the Edges, the whole Light at its Entrance being of one uniform Colour, whether White, Yellow, Orange, or Red, and going on thence perpetually without any Change of Colour, ſuch as the Confine of Shadow is vulgarly ſuppoſed to work in its refracted Light, at its Emergence.

Neither can theſe Colours ariſe from any new Modifications of the Light by Refractions, becauſe they change ſucceſſively from White, to Yellow, Orange, or Red, while the Refractions remain the ſame; and alſo, becauſe the Refractions are made contrary-ways by parallel Superficies, which deſtroy one another's Effects.

He ſhews alſo in *Experiment* 1. of this 2d *Book*, That by applying an Iron Wire, or ſuch like Body, to a proper Part of a very large Priſm, poſited about 20 Foot from the Hole of a darkened Room, you may ſo intercept the Rays at their Entrance, as to take away any one Colour (which you pleaſe) either wholly or in Part, out of the Spectrum or coloured Image, and leave the reſt remaining; which ſhews, that all Colours have an Indifference to any Confines of Shadow; and therefore the Differences of theſe, one from another, don't ariſe from the different Confines of Shadow, whereby the Light is variouſly modelled, as hath hitherto been the Opinion of Philoſophers. Again, a Lens being placed about 8 Foot from the Priſm at the Hole, had a Paper placed in its Focus, which, when it was ſituate perpendicular to the Light, appeared of its own Colour, White; but when very much oblique, appeared Yellow and Red when inclined one Way, and Blue when turned another; and yet here the Confines of Light and Shadow, and the Refractions of the Priſm, remained in all Caſes the ſame. And the Reaſon of the Phænomenon (he ſhews) is this: That the Paper in one Poſture being more oblique to the more refrangible Rays than to the leſs, is more ſtrongly illuminated by the latter than by the former; and therefore the leſs refrangible Rays are predominant in the reflected Light; and where-ever they are ſo, they tinge the Light with Yellow or Red; as when the Paper being placed in the contrary-way, and in an oblique Poſture, the more refrangible Rays become predominant; and they always tinge the Light with Blues and Violet Colours.

PROP. II.

All homogeneal Light hath its proper Colour anſwering to its Degree of Refrangibility; and that Colour cannot be changed by Reflections and Refractions.

This is plain by Experiment; for after he had ſeparated the ſeveral ſorts of Rays one from another (as he ſhews how to do in the Experiments belonging to the 4th Propoſition of his *Firſt Book*) and by that means got a Quantity of homogeneal Light: This Spot of homogeneal Light was afterwards uncapable of being changed by either Refraction or Reflection, and all Bodies placed in that homogeneal Light ſtill appeared of its Colour, however different their own proper Colours were from that: From whence he concludes, That if the Sun's Light conſiſted but of one ſort of Rays, there would be but one Colour in the whole World; nor would it be poſſible to produce any new Colour by Reflections and Refractions: And conſequently all the Variety of Colours depend upon the Compoſition of Light.

PROP. III.

Problem.

To define the Refrangibility of the ſeveral ſorts of homogeneal Light anſwering to the ſeveral Colours.

In this the Author is very curious and exact, ſhewing the Laws of the Refractions out of Glaſs into Air; whence, by the three Axioms of his firſt Book, the Laws of Refractions out of Air into Glaſs are eaſily derived. And finding by Experiment, That when Light goes out of Air, thro' ſeveral contiguous refracting Mediums (as thro' Water and Glaſs) and thence goes out again into Air, whether the refracting Surfaces be parallel or inclined to one another, that Light, as often as by contrary Refractions 'tis ſo corrected, as that it emergeth in Lines parallel to thoſe in which it was incident, continues ever after to be White: But if the immergent Rays be inclined to the incident, the Whiteneſs of the immerging Light, will (by Degrees) in paſſing on from the Place of Immergence, become tinged in its Edges with Colours. He thinks he can gather two Theorems (which he there gives) and by which the Refractions of the Rays of every ſort made out of any Medium into Air, are known by having the Refraction of the Rays of one ſort; and alſo, the Refraction out of one Medium into another, may be had as often as you have the Refractions out of them both into any third Medium. And theſe Theorems, if admitted into Opticks, would give a Scope to treat that Subject voluminouſly, after a new manner, not only by teaching thoſe things which tend to the Perfection of Viſion, but alſo by determining (mathematically) all kinds of Phænomena of Colours which could be produced by Refraction.

PROP. IV.

Colours may be produced by Compoſition, which ſhall be like the Colours of homogeneal Light, as to the Appearance of Colour, but not as to the Immutability of it; and the Conſtitution of Light and thoſe Colours, by how much more they are compounded, by ſo much are they leſs full and intenſe; and by too much Compoſition, they may be diluted and weakened, till they ceaſe. There may alſo Colours be produced by Compoſition, which are not fully like any of the Colours of homogeneal Light.

PROP. V.

Whiteneſs, and all Grey Colours between White and Black, may be compounded of other Colours; and the Whiteneſs of the Sun's Light is compounded of all the primary Colours mixed in a due Proportion.

This he proves by many Experiments, and in particular by this: That a Lens being placed to receive the coloured Spectrum caſt from a Priſm, at the Hole of a darkened Room, the Light in the Focus of a Lens converged, and there made a bright Spot, which received on a white Paper there, and in a right or normal Poſition to the Rays, appeared White on the Paper; but if either the Paper be moved towards the Hole, or behind the Focus of the Lens, it will preſently begin to appear coloured with the uſual Colours of the Priſm. Now the Reaſon of its appearing white at the Focus, was, becauſe there all the Rays were exactly mingled; for if any Colour, ſuppoſe the Red or Blue, were, by the Interpoſition of ſome Body, intercepted at the Lens, the Image in the Focus would never appear White, but ſome how coloured; ſo that to make Whiteneſs the Blending or Mixture of the Rays, is neceſſary. And then in

PROP. VI.

He propoſes this Problem: *In a Mixture of primary Colours, the Quantity and Quality of each being given, to know the Colour of the Compound.*

PROP. VII.

All the Colours in the Univerſe which are made by Light, and depend not on the Power of Imagination, are either the Colours of homogeneal Lights, or compounded of ſuch; and that either accurately or very nearly, according to the Rule of the preceding Problem.

For in *Book* II. *Prop.* I. he ſhews, That the Changes of Colours made by Refractions, do not ariſe from any new Modifications of the Rays impreſt by thoſe Refractions, and by the various Terminations of Light and Shadow, as has been the conſtant and general Opinion of Philoſophers. He has likewiſe proved, That the ſeveral Colours of the homogeneal Rays, do conſtantly anſwer to their Degrees of Refrangibility (*Prop.* I. *Lib.* I. and *Prop.* II. *Lib.* II.) and that their Degrees of Refrangibility cannot be changed by Refractions and Reflexions (*Prop.* II. *Lib.* I.) and by conſequence, that thoſe Colours are likewiſe immutable. He has alſo proved directly, by refracting and reflecting homogeneal Lights apart, that their Colours cannot be changed (*Prop.* II. *Lib.* II.). He has proved alſo, That when the ſeveral ſorts of Rays are mix'd, and in croſſing, paſs thro' the ſame Space, they do not act ſo upon one another, ſo as change each others colorifick Qualities (*Exp.* X. *Lib.* II.) but by mixing their Actions in the Senſorium, beget a Senſation differing from what either would do apart; that is, a Senſation of a mean Colour between their proper Colours; and particularly, when, by the Concourſe and Mixtures of all ſorts of Rays, a white Colour is produced, the White is a Mixture of all the Colours which the Rays would have apart (*Prop.* V. *Lib.* II.) The Rays in that Mixture do not loſe or alter their ſeveral colorifick Qualities, but by all their various kinds of Actions, mix'd in the Senſorium, beget a Senſation of a middling Colour between all the Colours, which is Whiteneſs; for Whiteneſs is a Mean between all the Colours, having itſelf indifferently to all, ſo as with equal Facility to be tinged with any of them. A red Powder mix'd with a little Blue, or Blue with a little Red, doth not preſently loſe its Colour; but a white Powder mix'd with any Colour, is preſently tinged with that Colour, and is equally capable of being tinged with any other Colour whatever. He has likewiſe ſhewn, That as the Sun's Light is mix'd of all ſorts of Rays, ſo its Whiteneſs is a Mixture of the Colours of all ſorts of Rays, thoſe Rays having, from the Beginning, their ſeveral colorifick Qualities, as well as their ſeveral Refrangibilities, and retaining them perpetually unchanged, notwithſtanding any Refractions or Reflexions they may at any time ſuffer; and that whenever any ſort of the Sun's Rays is by any means (as by Reflexion, in *Exper.* IX, X. *Lib.* I.) or by Refraction, as happens in all Refractions, ſeparated from the reſt, then they manifeſt their proper Colours.

Theſe things having been proved, ſays he, the Sum of all this amounts to the Propoſition here to be proved; for if the Sun's Light is mixed of ſeveral ſorts of Rays, each of which have originally their ſeveral Refrangibilities, and colorifick Qualities, and notwithſtanding their Refractions and Reflexions, and their various Separations and Mixtures, keep thoſe their original Properties perpetually the ſame, without Alteration; then all the Colours in the World muſt be ſuch as conſtantly ought to ariſe from the original colorifick Qualities of the Rays whereof the Lights conſiſt, by which thoſe Colours are ſeen: And therefore, if the Reaſon of any Colour whatever be required, we have nothing elſe to do but to conſider how the Rays in the Sun's Light have by Reflexions or Refractions, or other Cauſes, been parted from one another, or mixed together; or otherwiſe, to find out what ſorts of Rays are in the Light, by which that Colour is made, and in what Proportion; and then, by the laſt Problem, to learn the Colour which ought to ariſe by mixing thoſe Rays (or their Colours) in that Proportion. After this, in

PROP. VIII. and IX.

He ſhews, how by theſe diſcovered Properties of Light, to explain the Colours made by Priſms, and alſo thoſe of the Rainbow. And then in

PROP. X.

By the ſame diſcovered Properties of Light, he explains the permanent Colours of Natural Bodies.

Shewing that their Colours ariſe from hence, that ſome natural Bodies reflect ſome ſort of Rays, and others, other ſorts, more copiouſly and ſtrongly than the reſt: As for Inſtance, Minium, or Red-lead, reflects the leaſt refrangible, or Red making Rays moſt copiouſly, and thence appears Red: But Violets reflect the moſt refrangible moſt copiouſly, and thence have their proper Colour; and ſo of other Bodies. Every Body reflects the Rays of its own Colour more copiouſly than the reſt, and from their Exceſs and Predominance in the reflected Light, hath its Colour.

Then in his ſecond Book, Part I. and II. he takes into Conſideration the Phænomena of thoſe Colours which are obſerved in thin tranſparent Bodies, making many excellent Obſervations about their Reflexions and Refractions, and diſcovering many things as wonderful as they are certain. And here he finds new Reaſon to conclude, that the colorifick Diſpoſitions of Rays are alſo connate with them, and immutable; and conſequently, that all the Productions and Appearances of Colours in the World, are derived, not from any Phyſical Change cauſed in Light by Refraction or Reflexion, but only from the various Mixtures or Separations of Rays, by Virtue of their different Refrangibility, or Reflexibility; and in this Reſpect the Science of Colours becomes a Speculation as truly mathematical as any other Part of Opticks; that is, as far as they depend on the Nature of Light, and are not Creatures of the Imagination only. And in Part III. he diſcourſes again of the permanent Colours of Natural Bodies, and ſhews the Analogy between them and the Colours of thin tranſparent Plates; as alſo, ſhewing their Conſtitutions, whereby they reflect ſome Rays more copiouſly than others: As alſo, about the Colours which ariſe from the Inflexion of the Rays of Light: In all which there is intermixed many excellent Obſervations and curious Experiments relating to this moſt copious Subject.

Promiſcuous Obſervations and Experiments about Colours.

'Tis obſervable, that moſt tranſparent Bodies, when they are either ſplit, divided, or extended; ſo that they have no ſenſible Thickneſs upon their Surfaces, exhibit various Colours, like thoſe of the Rainbow. Thus it is with Muſcovy-Glaſs, when ſplit into exceeding thin Pieces, and fine Glaſs, when blown at the Flame of a Lamp, into Bubbles, as thin, or thinner, than the fineſt Paper; and ſo we ſee it is in thoſe Bubbles which Children make out of a Mixture of Soap and Water, and thoſe which ariſe from the ſhaking of almoſt any Chymical Oyl, or Spirit of Wine, into very fine Froth.

Mr. *Boyle* found, that one Grain of Cochineal diſſolved firſt into a pretty Quantity of Spirit of Urine, and then that Diſſolution diluted with Water, would impart a ſenſible, tho' but a faint Colour, to ſix Glaſſes of Water, each of which contained 43 Ounces and a Half, which amounts to above 125000 times its own Weight: And this ſhews the very great Diviſibility of the Parts of Matter, as well as the inteſtine Motion of the Parts of Fluid Bodies.

Dr. *Hook*, in his Micrography, ſeems to think there are but two original Colours, *viz.* Red and Blue, which, in Page 64, he defines thus: *Red is an Impreſſion on the Retina, made by an oblique and confuſed Pulſe of Light, whoſe ſtrongeſt Part precedes, and its weakeſt follows. Blue, an Impreſſion made by an oblique and confuſed Pulſe of Light, whoſe weakeſt Part precedes, and its ſtrongeſt follows.* Out of theſe two he ſuppoſes all other Colours may, by Mixture, *&c.* ariſe.

The Ways by which a Liquor may ſuddenly change the Colour of another Liquor, or of another Body, Mr. *Boyle* thinks reducible to ſuch as theſe:

1. By the minute Particles of the adventitious Liquors inſinuating themſelves into the Pores of the other, and filling them up either perfectly or in Part; by which means the Light paſſing thro', the Liquor will be differently refracted from what it was before, when the Pores of it were only filled with Air, or perhaps ſome more ſubtle Fluid.

2. A Liquor may alter the Colour of a Body, by freeing it from thoſe things which hindred it before from appearing in its genuine and proper Colour; as when Water waſhes off the Filth of ordinary Bodies, and other Lixiviums, or Menſtruums, clear away, or ſcour off the diſcoloured Ruſt of Metals; *&c.*

3. By making a Comminution of the Parts of any Body, and that either by really ſubdividing them, and making them leſs, or elſe by disjoining and ſeparating ſuch Aggregates or Cluſters of Particles which clung together before.

4. Contrary to the laſt Way, the Colour of a Body may be changed by means of a Liquor's making Coalitions or Aggregates of ſeveral Particles, which before lay too ſcattered and diſperſed, to exhibit any Colour; and this way the new Colours of Precipitates may be ſuppoſed in part to ariſe.

5. A Liquor may alſo change the Colour of a Body, by diſlocating and changing the Site and Poſition of the Parts of it: Thus bruiſed Fruits appear of a different Colour from their ripe and natural ones; and ſeveral Bodies are of a different Colour when diſſolved in a Menſtruum from what they had before.

6. The chiefeſt and moſt important way of all, as being that which doth contain many others within it, is by aſſociating the ſaline Corpuſcles, or any other ſort of the more rigid ones of the Liquor, with the Particles of the Body that it is employed to work upon, and by that means muſt needs alter the Figure, Poſition, Bigneſs, and Degree of Motion of the component Particles of that Body.

The Learned Dr. *Grew* thus ſums up the Reſult of abundance of curious Experiments about the Cauſes of *Vegetable Colours.*

1. While the Sulphur and ſaline Principles of Plants do only ſwim together, and are not yet united into one Precipitate, no Colour reſults from them, but the Contents are rather limpid, as uſually in the *Roots*, and many other *Parenchymous Parts*.

2. But when they are united, and the Alkalines are predominant, they produce a Green Colour.

3. When the Sulphur and Alkaline are more equal, they make a Tawny.

4. When the Sulphur, Acid, and Alkaline, are nearly equal, they produce a Yellow.

5. When the Sulphur is predominant, and the Acid and Alkaline equal, it makes a Blue. But

6. When the Sulphur and Acid are predominant to the Alkaline, it produces a Purple.

7. When the Sulphur is predominant to the Alkaline Principle, and the Acid to them both, it produces a Scarlet. But

8. When the Acid is predominant to the Alkaline, and the Sulphur to them both, a Blood-Red, which is the higheſt and moſt ſulphureous Colour in Nature. *Anatom. of Plants*, p. 276, 277.

Experiments of the ſudden Change of Colours.

1. Into a ſtrong Solution of Sublimate in common Water (the Quantity of a Spoonful or two) drop 5 or 6 Drops of good Spirit of Urine (or almoſt any volatile Spirit) and the Mixture will preſently appear White; which Whiteneſs may immediately be deſtroyed, by pouring in a little good *Aqua-Fortis.* The Tribe of Urinous Salts are diſtinguiſhed by producing this white Colour.

2. Drop a large Drop of Syrup of Violets on white Paper, it will ſpread and exhibit a tolerable blue Colour; then if you drop into it any Acid Spirit, or Stygian Liquor, as ſuppoſe a Drop of Spirit of Vitriol, 'twill immediately turn into a fine Red; whereas a Drop of Spirit of Urine, or any volatile Spirit, would have turned into a lovely Green; as alſo will a Drop of the Solution of Copper in Spirit of Urine, tho' it be of a deep Blue itſelf. *Note*, To make the Experiment appear the better, 'tis beſt to ſtir about or mingle the Liquors with the Tip of your Finger.

3. The eſſential Oil of Anniſeeds, in cold Weather, coagulates and turns whitiſh; yet if on this whitiſh Ointment, ſpread on white Paper, you let fall but a Drop or two of good Oil of Vitriol, a Heat and Smoak will ariſe, and a Blood-red Colour will be produced.

4. The adiaphorous Spirit of Box, mingled with a Solution of Mercury in *Aqua-Fortis*, made firſt a deep Yellow, and then, in a Minute or two, turned a deeply Red; and being digeſted a Day or two, let fall a white Precipitate. Mr. *Boyle.*

5. An Infuſion of an Handful of ſliced *Lignum Nephriticum* in four Pounds of Spring-water all Night, will give the Liquor that is poured off into a clear Glaſs-Phial a Colour almoſt like that of Gold, provided you hold up the Phial between your Eye and the Light: But when you hold it from the Light, ſo that your Eye be between the Light and it, it will appear of a deep and lovely blue Colour; which fine blue Colour, a few Drops of any acid Liquor, will immediately make diſappear, and about as many of Oil of *Tartar per Deliquium*, or any ſuch fix'd alkalizate Liquor will again reſtore.

6. Every one knows, that red Roſe-leaves held a while in the Smoak of Sulphur, will turn pale; and yet if you infuſe old diſcoloured Roſe-leaves that have been long dried in a Glaſs of Water, it will ſcarce impart any Colour to the Liquor; but on the dropping a due Quantity of the Spirit of Sulphur, the Liquor will turn into a lovely Red.

7. Tincture of red Roſe-leaves drawn with Water and a little Oil of Vitriol, was put into a clear Phial, about half full of fair Water, in ſuch a Proportion as that the Mixture was very red, but yet tranſparent; then into it was dropt leiſurely, a little

Spirit of Urine, and the Mixture being ſhaked, exhibited a fine greeniſh Blue.

8. If into a Spoonful of the Infuſion of Powder of Logwood in Water, which will be Red, you drop two or three Drops of Spirit of Urine, it will produce a lovely Purple; but if the Water which drew the Tincture from the Logwood, had been impregnated with Spirit of Salt, the Drops of Spirit of Urine, inſtead of Purple, would have produced a yellow Colour.

9. Three or four Drops of Oil of *Tartar per Deliquium* drop'd into a Spoonful or two of clear Solution of Sublimate in common Water, though the Liquors are both colourleſs, will in a Trice produce a deep yellow Colour; which, by dropping in four or five Drops of Oil, or ſtrong Spirit of Vitriol, may be as ſoon deſtroyed and made to vaniſh; and by putting in more of the Oil of Tartar, recovered again, *&c.* The Tribe of lixiviate Salts are known and diſtinguiſhed by this Teſt, that they will all produce this yellow Colour, when mix'd duly with a Solution of Sublimate.

10. Diſſolve Filings of Copper in good Spirit of fermented Urine, the Solution will be deeply Blue; but if into a Spoonful of this you drop two or three Drops of Oil of Vitriol, the ceruleous Colour will immediately vaniſh, and the Liquor become clear as Rock-water.

11. If three times its Weight of Oil of Vitriol be in a Glaſs Retort placed in Sand, drawn off from a Quantity of good Quick-ſilver, it will leave a Calx as white as Snow; which yet, as ſoon as ever common Water is poured on it, turns into one of the brighteſt and lovelieſt Yellow Colours in the World.

12. Diſſolve Camphire in Oil of Vitriol, and it will impart a deep, and almoſt opake Red, on the Menſtruum, tho' itſelf be White, and the Menſtruum, if good, clear, and tranſparent: And if into the Solution you pour a little Water, the Red Colour will vaniſh in a Trice, the Menſtruum grow pale, and the Camphire be recovered again in its priſtine Form.

A CATALOGUE *of the Simple Colours.*

1. *Spaniſh White*, made of *Chalk* and *Allum*, burnt together.
2. *Lapis Armenius*, ſuppoſed to be the ſame with the common *Blue Bice*.
3. *Ultramarine*, made of the blueſt *Lapis Lazuli*, which is freeſt from Gold Veins by Calcination.
4. *Smalt*, made of *Zaffer* and *Pot-aſhes* calcined together in a Glaſs-Furnace.
5. *Litmoſe*, ſuppoſed to be the Juice of a Plant.
6. *Indico*, by ſome ſaid to be a kind of Mud adhering to the Froth about Reeds in *India*. Others ſay it is a Plant like *Roſemary*, called *Intil*, growing in *Cambia*, which is gathered and dried, then wetted with fair Water, and beaten to a Mud; this Operation being repeated, it is dried and fitted for Uſe.
7. *Indian Ink*, whoſe Compoſition is ſuppoſed to be burnt *Rice*.
8. *Cerus*, or *Pſymithium*, is the Ruſt of Lead made by a vaporous Calcination.
9. *Maſticot*, is a kind of improper *Calx* of *Tin*.
10. *Gambodia*, or *Gutta Gambæ*, is ſuppoſed to be the inſpiſſated Juice of a *Plant* that comes from the *Indies*.
11. *Oker*, a ſort of natural Earth.
12. *Orpiment*, a fat inflammable Mineral, juſtly ranked amongſt *Poiſons*, for its extreme corroſive Quality.
13. *Umber*, a native Earth.
14. *Red-Lead*, made of Litharge, or Burnt Lead, by a reverberatory Calcination, or of *Ceruſs*, put on a Platter over the Fire, which muſt be continually ſtirred, till it has acquired a *Red-Lead* Colour.
15. *Burnt Oker*, is the common yellow *Oker* burnt in open Fire.
16. *Cinnabar*, or *Vermilion*, there are two ſorts; Native, or the Minium of the Ancients, which is a Mineral that yields *Quick-ſilver*, whereof and of *Sulphur*, it chiefly conſiſts. It is found in the Mines of *Iſtria*.

    The *Factitious Cinnabar* is that which we now uſe; and is made by a Sublimation of *Mercury* and *Sulphur*.
17. *Carmin*, made of *Cochineal*.
18. *Lake*, is made of *Flocks* dyed, or Shavings of *Scarlet-Cloth*, or of the *Cochineal Inſect*, or elſe of *Kermes-Berries*, their Tincture being extracted with a Lee of *Pot-aſhes*, and then precipitated with a Solution of *Roch-Allum*. After the ſame manner a *Lake* may be made of a Plant or Flower. There is alſo another ſort of *Lake*, made of *Gum-Lac*, by extracting its Tincture with *Urine*.
19. *Sanguis Draconis*, is the Gum of a Tree which looks like dried Blood; 'tis brought out of ſeveral Places in the *Eaſt-Indies*.
20. *Earth Reddle*, or *Ruddle*, found in many Places of *England*.
21. *Lamp-black*, made of *Soot* of *Roſin*, or *Pitch*, burnt in Places built on purpoſe for it, that keep in the Smoak.

COLOURS. Dr. *Hook*, in his *Oper. Poſt.* p. 54. from the Apparition of Colours in the triangular or hexangular *Striæ* of Cryſtal, where a lovely Variety of Colours is produced, in a way different quite from that which Nature takes in the Generation of Colours in other Bodies, as in Flowers, Blood, Metals, *&c.* he concludes, that all other *Hypotheſes* of Colours are overthrown, and that nothing beſides a *Refraction*, which is *conſiderable enough to obliquate the Pulſe of Light*, is neceſſary for the Production of Colours.

COLUMN [*Columna*, L.] in the *Military Art*, is the long File or Row of Troops, or of Baggage, of an Army in its March. To march in a *Column*, is to march a great Depth, or in a long File, inſtead of making a large Front. An Army marches in one, two, three, or more *Columns*, according as the Ground will allow, and as the General ſees expedient.

COLUMN [in *Architecture*] is properly that round long Cylinder, or Part of a Pillar, which is called the *Shaft*, *Trunk*, *Fuſt*, *Scapus*, *Vivo*, *Tige*, *&c.* containing the Body of it from the Spire to the Baſe, or from the Aſtragal of the Baſe to the Capital.

COLUMNÆ *Cordis*, are the Muſcles and Tendons by which the Heart is contracted and dilated; they are alſo ſeveral ſmall Muſcles in the Ventricles of the Heart, derived, and as it were, detached from the Parietes of the Ventricles, and connected by tendonous Extremities to the Valves of the Heart. Theſe little Pillars, or Columns, being faſtened to the Parietes of the Heart on one Side, and the tricuſpid and mitral Valves on the other, they do, by their Contraction in the Syſtole of the

Heart, draw out the Valves; and by that means, not only ſhut the Orifices of the Veins, but more exactly cloſe the Ventricles in their Syſtole.

COLUMNS. The principal Laws and Properties of a Column are thus deduced.

Every Fulcrum or Support is ſo much the more perfect, as it is the more firm, or carries the greater Appearance of Firmneſs; and hence all Columns or Pillars ought to have their Baſe or Foot broader than they are themſelves.

Again, as a Cylinder and a quadrangular Priſm are more eaſily removed out of their Place than a truncated Cone or Pyramid on the ſame Baſe, and of the ſame Altitude, the Figure of Columns ought not to be cylindrical, nor that of a Pilaſter pyramidical, but both the one and the other to be contracted or diminiſhed; *i. e.* to grow leſs and leſs, like a truncated Cone, and a truncated Pyramid.

For the ſame Reaſons, the loweſt Parts of the Columns cylindrical, that of Pilaſters pyramidical: Hence, again, as Columns are not firm, if their Diameter bears a greater Proportion to their Height than if it bore a leſs, the greater Ratio is to be choſen where a large Weight is to be ſuſtained, and a leſs where a leſs.

And beſides, as the Deſign of a Column is to ſupport a Weight, it muſt never be ſuppoſed without an Entablature; tho' a Colum needs no Pedeſtal, if it be raiſed in an eminent Place, ſo as to leave no Room for its being thruſt out of its Place.

The entire Column in each Order is compoſed of three principal Parts; the Baſe, the Shaft, and the Capital.

Each of theſe Parts, again, are ſubdivided into a great Number of leſſer, called Members or Mouldings; ſome whereof are eſſential, and found in all Columns; others are only accidental, and found in particular Orders.

Columns are made different, according to the ſeveral Orders they are uſed in; and likewiſe, not only in regard to their Order, but alſo to the Matter, Conſtruction, Form, Diſpoſition, and Uſe.

Columns, in regard to Order.

The *Tuſcan* Column is the ſhorteſt, and moſt ſimple of all the Columns: The whole Height of this Column, and the Height of each principal Part thereof, according to ſeveral Authors, is as in the following Table.

Authors Names.	Whole Height.		Pedeſtal.		Baſe.		Body.		Capital.		Architrave.		Frize.		Cornice.	
	Mo.	*Mi.*	*Mo.*	*Mi.*	*Mo.*	*Mi.*	*Mo.*	*Mi*	*Mo.*	*Mi*	*Mo.*	*Mi.*	*Mo.*	*Mi.*	*Mo.*	*Mi.*
Vitruvius.	11	5	2	20	0	30	6	0	0	30	0	30	0	45	0	40
Vignola.	11	5	2	20	0	30	6	0	0	30	0	30	0	45	0	45
Palladio.	10	15	1	0	0	30	6	30	0	30	0	30	0	45	0	35
Scamozzi.	11	15	1	52½	0	30	6	30	0	30	0	35	0	45	0	42

Note. In this and the four following Tables of the Heights of the Columns, and their Parts, the Dimenſions of the Authors, are reduc'd into Modules and Minutes, reckoning a Module the Diameter of the Body of a Column, juſt above the Baſe, and a Minute the 60th Part of a Module. 2. The Height of the Body of a Column is reckon'd from the Top of the Baſe to the Top of the Aſtragal, under the Capital.

The *Dorick* COLUMN is ſomething more delicate: See *Dorick*. Its Shaft is adorned with Flutings. The whole Height of this Column, and the Height of each principal Part of it, according to ſeveral Authors, is as in the following Table.

Authors Names.	Whole Height.		Pedeſtal.		Baſe.		Body.		Capital.		Architrave.		Frize.		Cornice.	
	Mo.	*Mi.*	*Mo.*	*Mi.*	*Mo.*	*Mi.*	*Mo.*	*Mi.*	*Mo.*	*Mi.*	*Mo.*	*Mi.*	*Mo.*	*Mi.*	*Mo.*	*Mi.*
Vitruvius.	12	40	2	40	0	30	7	0	0	30	0	30	0	45	0	40
Vignola.	12	40	2	40	0	30	7	0	0	30	0	30	0	45	0	45
Palladio.	13	0	2	20	0	30	7	45	0	30	0	30	0	45	0	35
Scamozzi.	12	58	2	26	0	30	7	30	0	30	0	35	0	45	0	42

The *Ionick* COLUMN is more delicate ſtill, and is diſtinguiſhed from the reſt by Volutes in its Capital, and by its Baſe. The whole Height of this Column, and the Height of each principal Part of it, is, according to ſeveral Authors, as in the following Table.

Authors Names.	Whole Height.		Pedeſtal.		Baſe.		Body.		Capital.		Architrave.		Frize.		Cornice.	
	Mo.	*Mi.*	*Mo.*	*Mi.*	*Mo.*	*Mi.*	*Mo.*	*Mi.*	*Mo.*	*Mi.*	*Mo.*	*Mi.*	*Mo.*	*Mi.*	*Mo.*	*Mi.*
Vitruvius.	14	15	3	0	0	30	8	10	0	20	0	37½	0	30	0	52½
Vignola.	14	15	3	0	0	30	8	10	0	20	0	37½	0	45	0	52½
Palladio.	13	28	2	40	0	52½	7	40	0	27½	0	34½	0	27	0	46½
Scamozzi.	12	33¾	2	30	0	30	7	30	0	18¾	0	35	0	28	0	42

The *Corinthian* COLUMN is the richeſt and moſt delicate of all the Columns: Its Capital is adorned with two Rows of Leaves, and with *Caulicole's*, whence ſpring out little Volutes. The whole Height of this Column, and the Height of each principal Member of it, is, according to ſeveral Authors, as in the following Table.

Authors Names.	Whole Height.		Pedeſtal.		Baſe.		Body.		Capital.		Architrave.		Frize.		Cornice.	
	Mo.	*Mi*	*Mo.*	*Mi.*	*Mo.*	*Mi.*	*Mo.*	*Mi.*	*Mo.*	*Mi.*	*Mo.*	*Mi.*	*Mo.*	*Mi.*	*Mo.*	*Mi.*
Vitruvius.	16	0	3	30	0	30	8	20	1	10	0	30	0	37½	1	0
Vignola.	16	0	3	30	0	30	8	20	1	10	0	45	0	45	1	0
Palladio.	13	54	2	20	0	30	7	55	1	5	0	36	0	28	0	50
Scamozzi.	14	42½	2	20	0	30	8	5	1	10	0	39	0	31⅗	0	46¼

The *Compoſit* COLUMN has two Rows of Leaves in its Capital, like the *Corinthian*; and angular Volutes, like the *Ionick*. The whole Height of this Column, and the Height of each particular Member of it, is, according to ſeveral Authors, as in the following Table.

Authors Names.	Whole Height.		Pedeſtal.		Baſe.		Body.		Capital.		Architrave.		Frize.		Cornice.	
	Mo.	*Mi.*	*Mo.*	*Mi.*	*Mo.*	*Mi.*	*Mo.*	*Mi.*	*Mo.*	*Mi.*	*Mo.*	*Mi.*	*Mo.*	*Mi.*	*Mo.*	*Mi.*
Vitruvius.	16	6½	3	30	0	30	8	20	1	10	0	52½	0	52½	0	52½
Vignola.	16	0	3	30	0	30	8	20	1	10	0	45	0	45	1	0
Palladio.	15	20	3	20	0	30	8	25	1	5	0	45	0	30	0	45
Scamozzi.	15	20	3	20	0	30	8	25	1	5	0	40	0	32	0	48

It may here be obſerv'd, that there ſeems to be more of Caprice than Reaſon, in that Diverſity found in the Heights of Columns of the ſame Order, in different Authors. For inſtance, *Vitruvius* makes the *Dorick* Columns, in Temples, ſhorter than thoſe of Porches behind Theatres, and each of them takes the Liberty of diſpenſing with his own Rules. *Palladio* gives a greater Height to Columns ſtanding on Pedeſtals, than to thoſe which have none. *Serlio* makes his Column a Third ſhorter when inſulate or detach'd, than when contiguous to the Wall.

But notwithſtanding the Diverſity of Heights in Columns of the ſame Order, in different Authors, they ſtill bear a due Proportion in the ſeveral Orders, when compared with each other, by which they go increaſing as the Orders are leſs maſſive.

But then this Augmentation is greater in ſome Ordonnances than in others; for in the Antique it is but of 5 Modules, or Semidiameters, for the 5 Orders: The ſhorteſt Column, *viz.* the *Tuſcan*, being 15 Modules; and the longeſt, the *Compoſite*, 20. In *Vitruvius* this Increaſe is alſo of 5 Modules, but commences from 14 Modules, and ends at 19. The Moderns uſually make it greater. *Scamozzi* makes it 5 Modules and a Half, and *Serlio*, 6.

There is a new Proportion drawn by Mr. *Perrault* from the ſeveral Proportions of Columns aſſigned by ſeveral Authors, which is a Mean betwixt the Extremes of the reſt. Thus he makes the *Tuſcan* Column 14 Modules and a Half, which is a Mean between the *Tuſcan* of *Vitruvius*, 14, and that of *Trajan's* Columns, 18: He makes the Height of the *Dorick* 16 Modules, which is a Mean between the 14 of *Vitruvius*, and that of the *Coliſeum*, 19. He makes the *Ionick* 17 Modules and One third, which is a Mean between the 16 of *Serlio* and the 19 of the *Coliſeum*. He makes the *Corinthian* 18 Modules and Two thirds, which is a Medium between the 16 Modules, 6 Minutes, of the Temple of the *Sybil*, and the 20 Modules, 6 Minutes, of the 3 Columns of the *Roman Forum*. Laſtly, By the ſame Rule he makes the *Compoſite* Column 20 Modules, which is a Mean Height between the Arch of *Titus* and the Temple of *Bacchus*.

Indeed the Rule he proceeds by ſeems to be very reaſonable, *viz.* that the progreſſional Advance of each Column in the different Orders be equal; ſo that having ſettled the whole Progreſſion, from the *Tuſcan* to the *Compoſite*, at 5 Modules, 10 Minutes; this being a Mean between the 5 Modules of the Antique, and the 5 and a Half of the Moderns; he divides this Sum, which is 160 Minutes, into 4 equal Parts, giving 40 Minutes to the Progreſſion of each Order. This makes the *Tuſcan* Column 14 Modules and 20 Minutes; the *Dorick* becomes 16; the *Ionick* 17 and 10 Minutes; the *Corinthian* 18, and 20 Minutes; and the *Compoſite* 20 Modules.

Of diminiſhing COLUMNS. *Columns* of every Order muſt be ſo form'd, that the Upper-part of the Body be leſs than the lower, which Diminiſhing muſt be more or leſs, according to the Proportion or their Heights, and is to begin from One third Part of the whole Shaft upwards (*i. e.* the lower third Part is to be of an equal Bigneſs) which *Philander* preſcribes (by his own preciſe meaſuring) as the moſt graceful Diminution: And for the Quantity to be diminiſhed Architects lay down this Rule:

$$\text{That the}\left\{\begin{matrix}\textit{Tuſcan}\\ \textit{Dorick}\\ \textit{Ionick}\\ \textit{Corinthian}\\ \textit{Compoſite}\end{matrix}\right\}\text{Column, be}\left\{\begin{matrix}\frac{1}{4}\\ \frac{1}{5}\\ \frac{1}{6}\\ \frac{1}{7}\\ \frac{1}{8}\end{matrix}\right\}\text{Part}$$

ſmaller at the Top, juſt under the Capital, than below, juſt above the Baſe, *i. e.* the Diameter of

$$\text{The Top of the}\left\{\begin{matrix}\textit{Tuſcan}\\ \textit{Dorick}\\ \textit{Ionick}\\ \textit{Corinthian}\\ \textit{Compoſite}\end{matrix}\right\}\text{Column, be}\left\{\begin{matrix}\frac{3}{4}\\ \frac{4}{5}\\ \frac{5}{6}\\ \frac{6}{7}\\ \frac{7}{8}\end{matrix}\right\}\text{of}$$

the Diameter of the Column below.

Columns are diſtinguiſhed according to the Matter of which they are made, as *Water*, *fuſible*, *tranſparent*, *hydraulick* Columns, *&c.* Alſo, in reſpect to their Conſtruction, as Columns of *Joinery*, *incruſtated*, or *geminated*; of *Maſonry*, with *Bands* or *Tambours*, in Truncheons or Pieces.

In regard to their Form, as *Fluted*, *Cabled*, *Twiſted*, *Coloſſal*, *Carolitick*, *Swell'd*, *Diminiſh'd*, *Gothick*, *Hermetick*, *Maſſive*, *Cylindrical*, *Oval*, *Polygonous*, *Paſtoral*, *Serpentine*.

In reſpect to their Diſpoſition, as *Inſulated*, *Inſerted*, *Niched*, *Angular*, *Attick*, *Flanked*, *Doubled*, *Coupled*, *Cantoned*, *Grouped*, *Median* Columns.

With reſpect to their Uſe, as *Aſtronomical*, *Chronological*, *Funeral*, *Gnomonick*, *Hiſtorical*, *Indicative*, *Inſtructive*, *Itinerary*, *Lactary*, *Legal*, *Limotrophous*, *Luminous*, *Manubiary*, *Memorial*, *Menian*, *Military*, *Phoſphorical*, *Roſtral*, *Sepulchral*, *Statuary*, *Symbolical*, *Triumphal*, *Zophorick* Columns.

COLUMN [in *Architecture*] taken in the largeſt Senſe, is a ſort of Pillar of a round Form, which ſerves to ſupport or adorn a Building conſiſting of a Baſe, a Shaft, or Shank (which is properly the *Column*) and a Capital. *Columns* are different, according to the ſeveral Orders of Architecture.

The *Tuſcan* being the ſhorteſt and moſt ſimple, is ſeven Models long, comprehending its Baſe and Capital, and diminiſhed a fourth Part of its Diameter.

The *Dorick* ought to be Seven and a Half, or Eight Diameters long; and its Baſe and Capital are ſomewhat more beautified with Mouldings.

The *Ionick* Column is nine Diameters long, and hath its Capital ſet off with Voluta's or curl'd Scrolls, differing in that Reſpect from others, as well as in its Baſe, which is peculiar thereto.

The *Corinthian* is the richeſt of all, having two Rows of Leaves for the Ornament of its Capital, with Stalks or Stems, from whence ſhoot forth ſmall Voluta's. Its Length is ten Diameters.

The *Compoſite* Column is likwiſe ten Diameters long, and its Capital is made like that of the *Corinthian*, with the angular Voluta's, or the *Ionick*.

COLUMELIA, the ſame with *Cion*.

COLUMNA *Naſi*, is the fleſhy Part of the Noſe, prominent in the Middle, near the upper Lip. *L.*

COLUMNA *Oris*, the ſame with the *Uvula*.

COLPUS, the ſame with *Sinus*.

COLURES [Κολȣροι, *Gr.*] are two great Circles ſuppoſed to paſs thro' the Poles of the World; one of them thro' the Equinoctial Points, *Aries* and *Libra*; and the other, thro' the Solſtitial Points, *Cancer* and *Capricorn*: Theſe are called the *Equinoctial* and *Solſtitial Colures*. And theſe divide the *Ecliptick* into four equal Parts, or Quarters, which are denominated accordingly: And the Points where theſe paſs thro' are called the *Four Cardinal Points*.

COMA *Somnolentorum*, is a deep Sleep, leſs than a Lethargy, without a Fever, wherein the Patient being awakened, anſwers to any Queſtion propounded to him, but falls into a profound Sleep again, with his Mouth open, and his under Jaw fallen, more like to one dead than alive. *Blanchard.*

COMA *Vigil*, waking Drowſineſs, is a Diſeaſe wherein the Patients are continually inclined to Sleep, but ſcarce can ſleep, being affected with a great Drowſineſs in the Head, a Stupidity in all the Senſes and Faculties, and many times with a *Delirium* too. *L.*

COMB [in a *Ship*] is a ſmall Piece of Timber ſet under the lower Part of the Beak-head, near the Middle: It hath two Holes in it, and ſupplies to the Fore-Tacks, what the Chief-Trees do to the Main ones; that is, to bring the Tacks aboard.

COMBARONS are the Fellow-Barons, or Commonalty of the Cinque-Ports, of the two ancient Towns, and their Members. The Members that repreſent them in the Houſe of Commons, are called *Barons of the Cinque-Ports*.

COMBATANT, the Herald's Word for two Lions bornr in a Coat of Arms, in a fighting Poſture, Rampant, and their Faces towards each other.

COMBINATION [*Combuſtus*, L. *burnt* or *ſcorched*] is the Art of finding how many different ways a certain given Number of things may be varied, or taken one and one, two and two, three and three, *&c.*

COMBINATION *of Quantities* is defined by Mr. *Strode*, in his Treatiſe on this Subject, printed 1678, to be the many ſeveral ways one may take any Number of Quantities, without having any Reſpect to their Places.

Col. Thornycroft's *Treatiſe of* Combinations, *from* Phil. Tranſ. N. 299. *in which the whole Affair of* Combinations, *and* Alternations, *is improved and completed.*

And, 1*ſt*. He premiſes,

That as, in the Notation of Powers, $a\ a\ a\ a\ b\ b\ b\ c\ c$ is deſign'd by $a^4\ b^3\ c^2$, and univerſally p times the Poſition of c, by $a\ p$, *&c.* ſo in things expos'd likewiſe (unleſs where 'tis propoſed they ſhould be all different) which Indices, as they have here no Relation to Powers, but expreſs only the Occurrences of thoſe things to which they reſpectively belong, I therefore call *Indices of Occurrences*.

2*dly*. That as often as I ſhall hereafter mention the *Combination* and *Alternations* of the $p^s\ q^s\ r^s$ or s^s, (which, conſider'd by themſelves, are capable of no Variation) I mean, of thoſe things whoſe Indices they are.

3*dly*. That m is generally put for the whole Number of Things expos'd, whether all different or not; *i. e.* equal to the Sum of their Indices; and n, for ſuch a Number of them as each *Combination* and *Alternation* muſt conſiſt of (unleſs preſuppos'd equal); which explains what is hereafter meant by the *Combinations* and *Alternations* of m things taken n and n, or of m things taken m and m: And the like Expreſſion, by whatever Symbols the Number of things out of which the *Combinations* and *Alternations* are to be made, or of which they are to conſiſt, may be deſign'd.

Lemma I.

If in a Right-line, at any Diſtance, be placed any Number of things, $a\ b\ c\ d$, *&c.* the Number of the Intervals, $a\ b$, $b\ c$, $c\ d$, *&c.* terminated each by two adjacent Things, is one leſs than the Number of Things.

For whereas every Interval is terminated by two adjacent Things, if to any Number of Things be added one Thing more, one Interval only is thereby added. Q. E. D.

Lemma II.

The Number of the Alternations of m Things, *a b c d, &c.* different each from other, take m and m, is m times the Number of the Alternations of $m-1$ things *a b c*, taken $m-1$ and $m-1$.

For (by *Lemma* I.) the laſt Letter *d*, beſides the Poſition it hath, may have $m-2$ Poſitions, *viz.* in the Intervals which are between $m-1$ things *a b c*; but it may alſo have one more, for it may be put firſt of all; it may therefore have m Poſitions: And thoſe in all the different Orders, whereof $m-1$ things are capable, which being all the poſſible Poſitions of *d*, in all the Varieties of *a b c*, is all the Variety whereof the whole Number of things expoſed, *a b c, &c*, is capable *Q. E. D.*

Lemma III.

The Number of the Alternations of m things, *a b c, &c.* different each from other, taken m and m, is equal to $m \times m-1 \times m\,m-2 \times m-3 \times m-4$, *&c.* continued to m Places

For let $m\,O$ expreſs the Number of the Alternations of m things, different each from other; $m-1\,O$, of $m-1$ things, and the like.

'Tis evident, that if $m=1$, it will be $m\,O=m$; for there can be but one Order of one thing.

And if m be greater than Unity, then it will be (by *Lem.* II.) $m\,O = m \times m-1\,O = m \times m-1 \times m-2\,O = m \times m-1 \times m-2 \times m-3\,O =$, *&c.* till we have have an Equation conſiſting of m Places; *i. e.* $= m \times m-1 \times m-2 \times m-3 \times$, *&c.* continued to m Places. *Q. E. D.*

Lemma IV.

If $m\,\omega$ expreſs the Number of the Alternations of m things, *a p, b p, c p, d p, e q, f r, &c.* taken m and m; and α the Number of p^s, β the Number of q^s, γ the Number of r^s, it will be

$$m\,\omega = \frac{m - m - 1 \times m - 2 \times m - 3 \times m - 4 \times m \times 5 \times, \&c. \text{ continued to } m \text{ Places.}}{p \times p-1 \times p-2 \times, \&c.\ \alpha \times q \times q-1 \times, \&c.\ \beta \times r \times r-1 \times, \&c,\ \gamma}$$

each Series continued to p, q, r, *&c.* Places, reſpectively.

For the Number of the Alternations of any Number of things, however divided into Parts, is produc'd by a continual Multiplication of the Alternations of thoſe things amongſt themſelves reſpectively, which compoſe each Part, into the Number of their Alternations, one amongſt the other; *i. e.* in the preſent Caſe (the ſeveral Occurrences being ſuppoſed to compoſe the ſeveral Parts, and conſequently the Number of the Alternations of the things compoſing each Part equal to Unity, $m\,\omega =$ to the Number of the Alternations of the things compoſing the Parts one amongſt the other; but the Number of their Alternations one amongſt the other, is the ſame in this Caſe, as if the things expos'd, being all different, were divided into the ſame Parts; for the things which compoſe each Part in both Caſes, are different from the reſt of the things expoſed, *i. e.* (by *Lem.* III.)

$$m\,\omega \times = \frac{m \times m-1 \times m-2 \times m-3 \times m-4 \times m-5 \times, \&c. \text{ continued to } m \text{ Places.}}{p \times p-1 \times p-2 \times, \&c. \mid \alpha \times q \times q-1 \times, \&c. \mid \beta \times r \times r-1 \times, \&c. \mid \gamma}$$

each Series continued to p, q, r, Places reſpectively. *Q. E. D.*

Lemma V.

The Number of the Combinations of m things, *a b c d, &c.* different from each other, taken n and n, is equal to $\dfrac{m \times m-1\ m-2 \times m-3 \times, \&c.}{n \times n-1 \times n-2 \times n-3 \times, \&c.}$ each Series continued to n Places.

For if the things expoſed be divided in two Parts, *viz.* in the Ratio of n and $m-n$, 'tis evident that their different Combinations taken n and n, are produced by the Alternations of the compoſing the Parts one amongſt the other: And therefore the Number of thoſe = to the Number of theſe = to the Number of the Alternations of m things taken m and m, the Indices of whoſe Occurrences are n and $m-n =$

$$\frac{m \times m-1 \times m-2 \times m-3 \times, \&c. \text{ continued to } m \text{ Places.}}{n \times n-1 \times, \&c. \times m-n \times m-n-1 \times, \&c.}$$

each Series continued to n and $m-n$ Places reſpectively, (by *Lemma* IV.) *i. e.* becauſe $n + m - n = m =$ $\dfrac{m \times m-1 \times m-2 \times m-3, \&c.}{n \times n-1 \times n-2 \times n-3, \&c.}$ each Series continued to n Places, (by *Lem.* III.) Therefore,

Lemma VI.

The Number of the Alternations of m things, *a b c d, &c.* different each from other, taken n and n, is $= m \times m-1 \times m-2 \times m-3 \times$, *&c.* continued to n Places. *Q. E. D.*

Scholium.

Since in the things expoſed the ſame things may occur more than once, and alſo n be leſs than m, the Indices of the Occurrences which are in ſome of the Combinations of m things taken n and n, may differ from thoſe which are in others; but thoſe Combinations, the Indices of whoſe Occurrences are the ſame, are ſaid to be in the ſame Form: Therefore, whereas n is equal to the Sum of the Indices which are in each Combination taken n and n, if n be expreſs'd by all the different Combinations of ſuch Indices only (being integer Numbers) whereof no one may exceed the higheſt Index of the things expoſed, and being more than one in a Combination, are each of them, which are in the ſame Combination, comprehended in a diſtinct Index thereof; theſe Expreſſions of n will neceſſarily be the ſeveral Forms of the Combinations taken n and n, whereof m things are capable: Whence is derived a General Theorem for finding the Combinations and Alternations of m things taken n and n univerſally; *i e.* Whether m conſiſt of things all different or not; and whether n be equal to, or leſs than m.

Theorem.

If n be expreſſed, according to all the different Forms of Combination which the things expoſed are capable of, and

$p =$ the higheſt Index
$q =$ the next higheſt
$r =$ the next higheſt
$ſ =$ the next higheſt
&c.

$\alpha =$ the number of p^s
$\beta =$ the number of q^s
$\gamma =$ the number of r^s
$\delta =$ the number of $ſ^s$
in ev'ry form of combination,

$\left.\begin{array}{l}A\\B\\C\\D\end{array}\right\}$ = the Number of all Indices not leſs than $\left\{\begin{array}{l}p.\\q.\\r.\\ſ.\end{array}\right\}$ Which are in the things expos'd,
&c.

And $b = \alpha + \beta$, $c = b + \gamma$, $d - c + \delta$, &c.

I ſay the Number of the Combinations of m things taken n and n, in any Form of Combination, ſhall be $\frac{A\times\overline{A=1}\times\overline{A-2},}{a\times\overline{a-1}\times\overline{a-2}}\times$, &c. $\times \frac{\overline{B-a}\times\overline{B-a-1}}{B\times\overline{\beta-1}}\times$, &c. $\times\frac{\overline{C-b}\times\overline{C-b-1}}{\gamma\ \overline{\gamma-}\times 1}\times$, &c. $\times\frac{\overline{D-c}\times\overline{D-c-1}}{\delta\times\overline{\delta-1}}$, &c. continued to ſo many Terms as there are different Indices in the Form of Combination, and each Term to α, β, γ, δ, &c. Places reſpectively, and this Number multiplied into

$$\frac{n\times\overline{n-1}\times\overline{n-2}\times\overline{n-3}\times\overline{n-4}\times\overline{n-4}\times\overline{n-5}\times\overline{n-6}, \&c.\ \text{continued to } n \text{ Places.}}{p\times\overline{p-1}\times\overline{p-2}\times,\&c \mid \alpha\times q\times\overline{q-1}\times,\&c. \mid \beta\times 1\times\overline{-1}\times,\&c. \mid \gamma\times,\ \&c.}$$

each Series continued to p, q, r, &c. Places reſpectively, ſhall be the Number of their Alternations.

But the Sum of all the Combinations and Alternations which are in every Form of n, ſhall be the whole Number of Combinations and Alternations of m things taken n and n.

Demonſtration.

Firſt then 'tis evident, that thoſe Combinations, which are in different Forms, differ from each other.

Again, 'Tis evident, that the Combinations of m things, as ap, bp, cp, dp, eq, fq, gq, kr, ir. &c. (the Indices ſimply conſidered) taken n and n, in a Form wherein are p^s, q^s, r^s, ſhall be equal to the Number of the Combinations of the p^s, which are in the things expoſed, taken α and α, multiplied into the Number of the Combinations of the q^s, taken β and β, multiplied into the Number of the Combinations of the r^s taken γ and γ.

But becauſe p, and all leſſer Indices, are comprehended in every Index which is greater than themſelves, therefore is A equal to the Number of p^s, which are in the things expoſed: And for the ſame Reaſon would be = the Number of the q^s, and C the Number of r^s: But the Number of the p^s, which are in every Form of Combination, is $= a$; therefore is $B - \alpha =$ to the Number of q^s: Alſo, becauſe the Number of p^s and q^s together, which are in every Form of Combination wherein there is q^s, is $= \alpha + \beta = b$; therefore is $C - b =$ to the Number of r^s, and ſo on, how many ſoever were the different Indices in any Form of Combination.

But (by *Lem.* V.) the Number of the Combinations of the p^s, which are in the things expoſed, whoſe Number is A, taken α and α, is $= \frac{A\times\overline{A-1}\times\overline{A-2}}{\alpha\times\overline{\alpha-1}\times\overline{\alpha-2}}$, &c. continued to α Places; and the Number of the Combinations of the q^s, whoſe Number is $B - 2$, taken β and β, is $= \frac{\overline{B-\alpha}\times\overline{B-\alpha-1}\times\overline{B-\alpha-2}}{\beta\times\overline{\beta-1}\times\overline{\beta-2}}$, &c. continued to β Places; and the Number of the Combinations of the r^s, whoſe Number is $C - b$, taken γ and γ, is $= \frac{\overline{C-b}\times\overline{C-b-1}}{\gamma\times\overline{\gamma-1}}$, &c. continued to γ Places, *Q. E. D.*

But every Combination in one and the ſame Form, affords the ſame Number of Alternations: Therefore the Number of Alternations in any one Form, is ſo many times the Number of Combinations, as is the Number of Alternations in any one of theſe Combinations.

But (by *Lem.* IV.) the Number of Alternations in any of theſe Combinations ſhall be

$$\frac{n\times\overline{n-1}\times\overline{n-2}\times\overline{n-3}\times\overline{n-4}\times\overline{n5}\times\overline{n-6}\times, \&c.\ \text{continued to } n \text{ Places.}}{p\times\overline{p-1}\times\overline{p-2}\times,\&c \mid \alpha\times q\times\overline{q-}\times,\&c. \mid \beta\times t\times\overline{r-1}\times,\&c. \mid \gamma\times,}$$

each Series continued to p, q, r, &c. Places reſpectively. *Q. E. D.*

Now makee to an Application of this general Rule, to thoſe particular Caſes which have already been conſider'd by others, and which are contain'd in our 3d, 4th, 5th, and 6th *Lemma's*, and by us more generally demonſtrated; I ſay,

If $n = m$, there can be but one Form of Combination, and but one Combination in that Form; and therefore the Number of Alternations $=$

$$\frac{m\times\overline{m-1}\times\overline{m2-}\times\overline{m-3}\times\overline{m4}\times, \&c.\ \text{continued to } m \text{ Places.}}{p\times\overline{p-1}\times,\&c. \mid \alpha\times q\times\overline{q-}\times,\&c. \mid \beta\times r\times,\&c. \mid \gamma\times,\&c.}$$

each Series to p, q, r, &c. Places reſpectively; *i. e.* (if $p = 1$) $= m\times\overline{m-1}\times\overline{m-2}\times\overline{m-3}\times\overline{m-4}\times$, &c. continued to m Places, which are the Caſes of the 4th and 3d *Lemma's*.

But if the things expos'd are all different, and n be leſs than m, which is the Caſe of the 5th and 6th *Lemma's*, then alſo can there be but one Form of Combination, and it will be $A = m$, and $\alpha = n$, and the whole Number of Combinations $= \frac{A\times\overline{A-1}\times\overline{A-2}\times, \&c.}{\alpha\times\overline{\alpha-1}\ \overline{\alpha-}\times 2, \&c.}$

i. e. $= \frac{m\times\overline{m-1}\times\overline{m-2}\times, \&c.}{n\times\overline{n-1}\times\overline{n-2}\times, \&c.}$, each Series continued to n Places, and therefore the Number of Alternations $= m + \overline{m-1}\times\overline{m-}\times 2$, &c. continued to n Places.

But fully to illuſtrate this Theorem, which, as delivered in general, may ſeem ſomewhat too abſtracted to be commonly underſtood, I ſhall ſubjoin one ſhort Example.

Example.

Let the things expos'd be $a\,a\,a\,b\,b\,b\,c\,c$, or according to our way of Notation, a^3, b^3, c^2; 'tis required to find the Number of their Combinations and Alternations taken 4 and 4.

Then (becauſe in the things expos'd there is no one thing occurs more than thrice, nor more then three things different from each other) will all the Forms of Combination, which the things expoſed are capable of, be theſe:

Viz. $\left\{\begin{array}{l}3\ .\ 1\\2\ .\ 2\\2\ .\ 1\ .\ 1\end{array}\right\}$ Then

In the firſt Form will $p = 3,\ q = 1,\ \alpha = 1,\ \beta = 1,\ A = 2,\ B = 3.$
In the 2d Form will $p = 2$, ——, $\alpha = 2$, ——, $A = 3$, ——.
In the 3d Form will $p = 2,\ q = 1,\ \alpha = 1,\ \beta = 2,\ A = 3,\ B = 3.$

The Number of Combinations :

$$\text{In the firſt Form} = \frac{A}{\alpha} \times \frac{B - \alpha}{\beta} = \frac{2}{1} \times \frac{2}{1} = 4$$

$$\text{In the 2d Form} = \frac{A \times \overline{A - 1}}{\alpha \times \overline{\alpha - 1}} = \frac{2 \times 2}{2 \times 1} = 3$$

$$\text{In the 3d Form} = \frac{A}{\alpha} \times \frac{\overline{B - \alpha} \times \overline{B - \alpha - 1}}{\beta \times \overline{\beta - 1}} = \frac{2 \times 1}{2 \times 1} = 3$$

$$\text{And the whole Number of Combinations} = \overline{10}$$

Alſo the Number of Alternations :

$$\text{In the firſt Form} = 4 \times \frac{n \times \overline{n-1} \times \overline{n-2} \times \overline{n-3}}{p \times \overline{p-1} \times \overline{p-2} \,|\, \alpha \times q^{\beta}} - 4 \times \frac{4 \times 3 \times 2 \times 1}{3 \times 2 \times 1 \,|\, 1 \times} = 4 \times 4 = 16$$

$$\text{In the 2d Form} = 3 \times \frac{n \times \overline{n-1} \times \overline{n-2} \times \overline{n-3}}{p \times \overline{p-1} \,|\, \alpha} = 4 \times \frac{4 \times 3 \times 2 \times 1}{2 \times 1 \,|\, 2} = 3 \times 6 = 18$$

$$\text{In the 3d Form} = 3 \times \frac{n \times \overline{n-1} \times \overline{n-2} \times \overline{n-3}}{p \times \overline{p-1} \,|\, \alpha \times q\beta} = 3 \times \frac{4 \times 3 \times 2 \times 1}{2 \times 1 \,|\, 1 \times 12} = 3 \times 12 = 36$$

$$\text{And the whole Number of Alternations} = \overline{70}$$

Many are the Properties of this Theorem, in common with others; as, To find the *Unciæ* of a Multinominal raiſed to any integer Power: To raiſe an infinite Series to an integer Power, though of an interrupted Order, without introducing any thing immaterial, or which muſt afterwards be expung'd; and many others. But then ſo many Terms of the Series muſt be taken in at firſt, as ſhall ſerve to the Purpoſes of the intended Proximation, otherwiſe as often as it ſhall fall ſhort of that, the Operation muſt be begun *de novo*.

Many likewiſe are the Properties due to this Theorem, and great Variety of Problems might be fram'd; and I ſcruple not to ſay, many may occur in Practice, which are ſolvable by this, and no other Method whatever.

Hence may be found the Number of all Words whereof the 24 Letters are capable, from one Letter in each Word, to any Number of Letters given.

Hence may be found the Number of all Numbers, to any given Number of Places, which may be produced from any Number of Figures given.

Hence alſo the Compaſs of a Muſical Inſtrument being given, the Time and Number of the Bars, whereof each Tune ſhall conſiſt, the Number of Tunes may be found, which that Inſtrument is capable of.

To give an Inſtance of the prodigious Variety that there is in Muſick, I have calculated the Number of Tunes in common Time, conſiſting of eight Bars each, which may be plaid on an Inſtrument of one Note Compaſs only; and it is this, *viz.* 27584.270157.013570.368586.999728.299176. whereas the Changes on Twenty-four Bells, is but 620448.401733.239439.360000. which is but $\frac{1}{44588.604583}$ of the Number of Tunes: And yet Dr. *Wallis* (in his *Algebra*) demonſtrates, could not be diſpatch'd in 31557.600000.000000 Years.

If then the Inſtrument were of as many Notes Compaſs as any Inſtrument now in uſe, how prodigiouſly muſt the Number of Tunes be increaſed? the Calculation of which (tho' much more intricate and operoſe) would be equally attainable by our Theorem.

COMBUST [*Combuſtus*, L. *burnt* or *ſcorched*] a Term in Aſtronomy: When a Planet is not above 8 Degrees and 30 Minutes diſtant from the Sun, either before or after him, he is ſaid to be *Combuſt*, or in *Combuſtion*.

COMBUST [in *Aſtrology*] the Space of the Half *Libra* and all *Scorpio*, ſo call'd upon account of ſeveral violent and ill-boding Stars, that, as they pretend, are fixed there; ſo that they account it unfortunate and weakening to any Planet that happens to be in it.

COMETS are what are commonly called *Blazing-Stars*. The Ancients, eſpecially *Ariſtotle* and his Followers ſuppoſed them to be Meteors, or Exhalations, ſet on Fire in the higheſt Region of the Air: The modern Aſtronomers have found them to be above the Orbit of the Moon, but yet to deſcend ſo low as to move in the Regions of the Planets: It is not improbable but that they may be a ſort of very Eccentrical Planets, and move periodically about the Sun.

Mr. *Azout*, a *French* Gentleman, was the firſt, as I can find, who pretended to predict what would be the future Motion of a Comet; which he did for one that appeared in *Jan.* 1664-5, and ſent Copies of them to the Secretary of the Royal Society, *Jan.* 2. 1664. N. S. He alſo did the ſame for a ſecond Comet, which appeared the Year following.

Hevelius, in his *Prodromus Cometicus*, ſaith, He is almoſt poſitive, no Account can be given of the *Phænomena* of *Comets*, without ſuppoſing the annual Motion of the Earth.

Meaſuring the *Comet* in the Year 1664-5, he found it to be diſtant from the Earth above 5000 Semi-diameters of the ſame; and that its true Diameter was then 25600 *German* Miles, which is 3 times as long as the Diameter of the Earth.

He ſuppoſes all of them to move round the

Sun as their Centre, and to be a kind of ſpurious Planets.

Their Train, or Coma, he takes to be occaſioned by the Beams of the Sun falling on the Head of the Comet, and paſſing thro' the ſame reflected and refracted.

Afterwards, in 1668, he publiſhed his *Cometographia*, wherein he ſuppoſes, that the Trajectory of a Comet is nearly Rectilinear, or that they always move in a ſtraight Line.

Yet he ſuppoſes alſo a Motion impreſſed, and an Inclination of the Comet's Disk to the Sun, as two Cauſes why Comets may ſometimes deviate from a ſtraight Courſe, eſpecially about the Beginning and End of their Appearance.

He obſerves, That this Line is ſomething near that of a Parabola ſometimes, but never is the Ark of any Circle: Alſo, that there is in Comets a Libratory Motion, like that in the Moon.

The famous Sir *Iſaac Newton*, in his excellent *Principia Philoſoph. Mathem.* hath a large Diſcourſe of Comets, p. 473, *&c.* where he proves:

1. That they are above the Moon, and in the Region of the Planets, becauſe they have no Diurnal Parallax, but an Annual one: For thoſe Comets which move forward, according to the Order of the Signs, are all, at their Exit or Diſappearance, ſlower in their Motion than they were before, or (retrograde) if the Earth be between them and the Sun; but they move ſwifter than ordinary when they begin to diſappear, if the Earth be in oppoſition to the Sun: And on the contrary, if they move contrary to the Succeſſion of the Signs, and have the Earth between them and the Sun, then they move more ſwift than ordinary at their Exit; but if the Earth be in oppoſition, they move ſlower, and retrograde towards their going off. This chiefly depends on the Motion of the Earth, as it is in the Planets; who, according as the Earth's Motion agrees with, or is contrary to theirs, appears ſometimes retrograde, ſometimes to move ſlower, and other times more ſwiftly.

If the Earth move the ſame way with the Comet, and ſwifter by its angular Motion round the Sun than the Comet; the Comet, when beheld from the Earth, will appear to be retrograde.

And if the Earth move ſlower than it, the Motion of the Comet (ſubducting the Motion of the Earth) will be, to Appearance, ſlower.

But if the Earth move a contrary way to the Comet, it will then appear to move ſwifter than the Earth: All which he illuſtrates and proves, and ſhews alſo a Way from the Comet's Parallax, to find its Diſtance.

From the Conſideration alſo of the Curvity of the Way of a Comet, he concludes, That when they diſappear, they are much below the Orb of *Jupiter*; and that in their *Perigeums* and *Periheliums*, they often deſcend below the Orbits of *Mars* and the inferior Planets.

From the Light alſo of the apparent Star that is in the Head of the Comet, he concludes their Vicinity to the Sun and Earth; and that they can by no means be in the Region of the fix'd Stars, as ſome have imagined, for then their Heads could no more be enlightened by the Sun, than the Planets are by the fix'd Stars.

Conſidering alſo the Obſcuration of the Comet by that thick Fume or Vapour with which its Head is always encompaſſed, he concludes, That they muſt often deſcend down below the Sphere of *Saturn*, as he had before found by their Parallax. The ſame thing he concludes alſo, by examining into the Cauſe of the Coma, or Tail, and then draws theſe *Corollaries.*

1. That Comets ſhine by the Light of the Sun's Beams reflected from them.

2. That the Heavens are devoid of all Reſiſtance, ſuch as our Air and other Mediums have: For theſe Comets move every way, with all the Freedom that can be, obliquely, directly, and often againſt the Courſe of the Planets, and yet can continue their Motion for a very long while, even ſo: And therefore the Celeſtial Regions cannot be filled with Matter like the *Carteſian* Vortices, but muſt be almoſt void Spaces.

Next, in *Prop.* 40. *Book* 3. he proves, That Comets move round the Sun in Conick Sections, having their *Umbilici* in the Centre of the Sun; and that by Lines drawn from themſelves to the Sun, they deſcribe Area's proportional to their Times of Revolution, as the other Planets do: And he ſeems to think them a kind of Planets, and that they revolve in real Elliptical Orbits, tho' they nearly approach to Parabola's. From which Propoſition he concludes,

1. That if Comets do ever come about again, their Orbits are very Eccentrical Ellipſes; and that their perodical Times are to thoſe of the Planets in a ſeſquilateral Ratio of the tranſverſe Axis; and therefore Comets being uſually above the Planets, and deſcribing Orbits of longer Axes than they, do really move ſlower than they; and particularly, that if the Ax of the Orb of a Comet were 4 times as long as the Ax of *Saturn*'s Orbit, the Time of the Revolution of the Comet to that of *Saturn*, would be $4 \times \sqrt{4}$, or 8 to 1; that is, 240 Years.

After this, in ſeveral *Lemma's*, he prepares the way to determine the Species of the Conic Section a Comet deſcribes; to find its Place at any intermediate given Time; and to determine the Trajectory from three Obſervations, which he illuſtrates by Examples.

Then he proceeds to conſider more particularly what the Bodies of Comets are, and concludes, that they are ſolid, compact, fix'd, and durable, like thoſe of the other Planets. Refuting the old Opinion of their being Meteors, or Exhalations from this, That in their Tranſits, ſo near the Sun as we find they do go, they wou'd be perfectly diſſipated, diſperſed, and deſtroyed.

The Heat of the Sun he had before ſhewn to be as the Denſity of the Rays, or reciprocally as the Squares of the Diſtances of Places from the Sun: Wherefore, ſince the Diſtance of the Comet which appeared in the Year 1680, being in its Perihelion the 8th of *December*, was then to the Diſtance of the Earth from the Sun, as 6 to 1000 nearly. The Sun's Heat in the Comet at that time, was to his Heat with us at Midſummer, as 1000000 to 36, or 28000 to 1; whereas the Heat of boiling Water, as he tried, was but very little more than triple the Heat of our dry Earth expoſed to the Midſummer's Sun, and the Heat of red-hot Iron, he conjectures to be about three or four times as great as that of boiling Water: Wherefore the Heat of the dried Earth, or Body of the Comet in its Perihelion, was near 2000 times as great as that of red-hot Iron; and conſequently, if the Comet had been a Meteor, or an Aggregate of Vapours and Exhalations, the Sun would have rendered it inviſible.

The Comet therefore acquired ſo great, ſo immenſe a Degree of Heat in its Perihilion, that it muſt needs be a long time before it will be cold again; for he computes, that a Globe of red-hot Iron, of the Dimenſions of our Earth, would ſcarce be cool in 50000 Years. If therefore we ſuppoſe the Comet to cool 100 times as faſt as red-hot Iron, yet ſince his Heat was 2000 times greater than that of red-hot Iron, if you ſuppoſe his Body to be of the ſame Bigneſs of our Earth, he will not be cool in a Million of Years.

He obſerves alſo, That the Tails of all Comets are longeſt and largeſt after their paſſing from the Sun, or juſt after their Perihelions; which ſhews, that the Sun's Heat contributes to the Increaſe of the Tail. Whence 'tis more than probable, that the Tail of a Comet is only a long and very thin Smoak, or Train of Vapours, which the ignited *Nucleus*, or the Head of the Comet emits from it. And this Notion he confirms after this, by refuting the two other Opinions about the Origin of the Tail of a Comet.

For ſome will have it to be only the Sun-beams ſhining thro' the Head of the Comet, as they do thro' a Creviſe into a dark Place, and by that means come to appear in that Form.

But this Notion, he ſhews, will not hold, becauſe the Reaſon that the Sun-beams appear thus lucid, when his Rays ſhine thro' an Hole or Chink into a dark Place, is, becauſe the Light is reflected from the Particles of Smoak, ſmall Duſt, *&c.* which continually fly to and fro in the Air, and therefore is always more ſplendid where the Air abounds with the moſt groſs and greateſt Number of Particles of this Nature. But in a thin and clearer Air, no ſuch Appearance can well be ſeen; and conſequently in the Celeſtial Regions, where probably there is little or no Matter to reflect, cannot be viſible: For Light, as in the Sun-beams only, is not diſcernable, but only ſo far as it is from thence reflected to our Eyes.

Others will have the Tails of Comets to be formed by the Refraction of Light, as it paſſes thro' the Head of the Comet to the Earth: But this Opinion he thinks, is preſt with many ſcarce anſwerable Difficulties: For firſt, the Tails of Comets never appear adorn'd with various Colours, which yet are uſually the inſeparable Concomitants of Refraction. Again, the Light of the fix'd Stars and Planets coming to us directly, and tranſmitted diſtinctly, plainly ſhews, that the Celeſtial Mediums it paſſeth thro' have no refracting Power. And as to the Radiation and Twinkling of the fix'd Stars, that ought to be attributed rather to a Refraction in our Eyes, or to be occaſioned by the tremulous Motion of the Air; becauſe, when we look on them thro' a Teleſcope, there is no ſuch thing. The Tremor of the Air, and of the aſcending or deſcending Vapours, may eaſily occaſion a little quick ſucceſſive Diſtortion of the Rays from ſo ſmall a Point as the Pupil of one's Eye; but they cannot do ſo from the much larger Aperture of a Teleſcope's Object Glaſs, which is the Reaſon why there is an apparent Twinkling in the former, but not in the latter Caſe; and the Ceſſation of the Scintillation in the latter, is a Demonſtration, that there is a regular Tranſmiſſion of the Rays of Light, without any ſenſible Refraction.

Laſtly, If the Tails of Comets were produced by the Refraction of the Sun's Light ſhining thro' them towards us; and according to the Figure of the Heavens, were reflected to Parts oppoſite to the Sun, that Deflection in the ſame Regions of the Heavens muſt always be made towards the ſame Parts: But this, by plain and undoubted Obſervation, hath been found to be falſe in Fact, and therefore this Account cannot be the true one.

That the Tails or Beards of Comets do ariſe from the *Nucleus* or Head, and aſcend towards the Regions oppoſite to the Sun, is confirmed by the Laws which they obſerve; as, that lying in the Planes of the Orbits of Comets which paſs thro' the Sun, they deviate from the Oppoſition of the Sun always towards thoſe Parts which their Heads, as they move forward, leave in theſe Orbits: That to a Spectator placed in thoſe Planes, they appear in Parts directly oppoſite to the Sun; but that if the Spectator deviate a little from theſe Planes, their Deviation will become ſenſible, and every Day appear greater and greater: That the Deviation, all things conſidered, is leſs where the Tail is oblique to the Orbit of the Comet; as alſo when the Head of the Comet approaches nearer to the Sun, eſpecially if the Angle of the Deviation be obſerved near the Head of the Comet; beſides, that thoſe Tails which do not deviate, appear ſtraight; but thoſe that do, appear curved: That the Curvature is greater where the Deviation is greater, and more ſenſible where the Tail is of greater Length; for in ſhort ones it is hardly obſervable: That the Angle of Deviation is leſs near the Head of the Comet, and greater near the oppoſite Extreme; and therefore that the Tail turns its convex Parts towards the Place from which the Deviation is made, and which are in a Right-line drawn from the Sun thro' the Head of the Comet, and produced infinitely: And that thoſe Tails which are larger and longer, and which ſhine brighteſt, are more ſplendid towards their convex Sides, and are better defined, or more diſtinctly terminated there, than on their concave Sides.

Wherefore the Phænomena of the Tails of Comets depend upon the Motion of their Heads, and not upon the Region of the Heavens in which the Head is ſeen; and therefore do by no means ariſe from Refraction in the Heavens, but have their Matter ſupplied from the Head.

For, as in our Air the Smoak of any kindled Body aſcends upright, if the Body be at reſt; but obliquely if it have a lateral Motion any way: So in the Heavens, where Bodies gravitate towards the Sun, Smoak and Vapours ought to aſcend up from the Sun, and that in a Right-line, if the ſmoaking Body be at reſt; or obliquely, if it move any way laterally, and by its progreſſive Motion, doth always deſert thoſe Spaces from whence the ſuperior Parts of the Vapours had aſcended: And this Obliquity will be leſs where the Aſcent of the Vapours is more ſwift, *viz.* near the Sun, and near the ſmoaking Body. From the Diverſity of this Obliquity, the Column of the aſcending Vapour will be incurvated; and becauſe the Vapour in the precedent Side of the Column, is ſomething newer or more recent than the other, it will therefore be a little more denſe, and conſequently more copiouſly reflect the Light, and be defined or terminated more diſtinctly than the other Side.

That there may ariſe from the Atmoſphere of Comets, Vapours enough to take up ſuch immenſe Spaces, may be underſtood from the Rarity of our Air: For Air near the Surface of our Earth, takes up a Space 850 times as large as Water of the ſame Weight with it; and therefore a Column of Air of 850 Foot high, weighs no more than one of Water of but one Foot high, if they have both the ſame Baſe. But a Column of Air of the Height of the whole Atmoſphere, weighs no more than a Column of Water of about 33 Foot high, and of the ſame Baſe; and therefore, if from this whole Column of Air you ſubtract the lower Part as far as the Height of 850 Foot, the remaining Column will weigh equal to a Column of Water of 32 Foot; from whence, by that Hypotheſis which is now confirmed by many Experiments, it may be fairly concluded, that *the Compreſſion of the Air is as the Weight of the incumbent Atmoſphere; and that Gravity is reciprocally as the Square of the Diſtance of Places from the Centre of the Earth.* I found by Circulation, ſaith he, (the Ground of which he gives in *Prop.* 22. *Lib.* 2.) that Air, at the Diſtance of our Earth's Surface, of only one Semi-diameter of the Earth, is more rare than it is with us in a Ratio much exceeding that which all the Space below the Orb of *Saturn* bears to the Diameter of a Globe of only one Inch in Length: And therefore a Globe of our Air, of only one Inch in Diameter, if it had but the ſame Degree of Rarity which our Air hath at the Diſtance of 4000 Miles, or of the Earth's Semi-diameter from us, would more than fill all the Regions of the Planets, as far as the Sphere of *Saturn*, and much farther. Wherefore ſince Air, as you go higher, will ſtill grow immenſely rare, and that the Coma or Atmoſphere of a Comet, counted from its Centre, is about 10 times higher than the Superficies of the *Nucleus*, the Tail of it aſcending much higher, muſt needs be exceedingly rare.

And tho', becauſe of the great Craſſitude of the Atmoſphere of Comets, and the great Gravitation of Bodies towards the Sun, and the Gravitation of the Particles of Air and Vapour towards one another, it may be that the Air in theſe Celeſtial Spaces, and in the Tails of Comets, may not be rarefied quite ſo much; yet 'tis plain by this Computation, that a very little Quantity of Air and Vapour will ſuffice to ſolve all the Phænomena of the Tails of Comets.

For the very great Rarity of the Tails of Comets may be concluded by the fix'd Stars ſo plainly appearing thro' them, as we find they do. The Atmoſphere of our Earth ſhining with the Sun's Light, tho' perhaps its Thickneſs be but a few Miles, yet quite extinguiſhes all the Light of the fix'd Stars, and obſcures the Moon itſelf; whereas the immenſe Thickneſs of the Tail of a Comet, illuſtrated, as our Atmoſphere is, by the Rays of the Sun, will permit the ſmalleſt fix'd Stars to be ſeen thro' it, without any Diminution of their Brightneſs.

And the Tails of moſt Comets have no greater Splendor than the Sun-beams exhibit when reflected from a Stream of Motes, Duſt, *&c.* in a darkened Room, of but one or two Inches in Thickneſs.

At what time the Vapour aſcends from the Head, to the Extremity of the Tail, may be almoſt diſcovered by drawing only a Right-line from the End of the Tail to the Sun, and then noting the Place where that Right-line cuts the Trajectory: For the Vapour in the Extremity of the Tail, if it aſcend in a Right-line from the Sun, will begin its Aſcent at the time when the Head of the Comet is in the Place of Interſection.

But indeed the Vapour doth not aſcend in a Right-line from the Sun, but by retaining the Motion of the Comet which it had before its Aſcent, and compounding it with the Motion of its Aſcent, it aſcends obliquely; wherefore it will be a truer Solution of the Problem, to ſuppoſe the Right-line which interſects the Orbit, to be parallel to the Length of the Tail, or rather (becauſe of the curvilinear Motion of the Comets) that it diverge from the Line of the Tail. By this means I found, that the Vapour which was in the Extremity of the Tail, *Jan.* 25. began to aſcend from the Head before *Dec.* 11; and therefore had taken up more than 45 Days in its Aſcent: But all that long Tail which appeared *Dec.* 10, aſcended in the Space of thoſe two Days, which were then juſt paſt ſince its Perihelion; wherefore the Vapour at the Beginning, when the Comet was near the Sun, aſcended prodigiouſly ſwift, and afterwards continued to aſcend with a Motion retarded by the Gravity of the Particles, and by that Aſcent encreaſeth the Length of the Tail: But the Tail, as long as it appeared, conſiſted almoſt all of that Vapour which aſcended from the time of the Perihelion; and the Vapour which firſt aſcended and compoſed the Bounds of the Tail, did not vaniſh till it was both too far off the Sun to be illuminated by him, and off us to be viſible. Hence alſo the Tails of Comets which are ſhorter, do not aſcend with a quick and continual Motion from the Head, and then preſently vaniſh and diſappear; but are permanent Columns of Vapours and Exhalations, gathered from the Head, by a very gentle Motion, and in a great Space of Time; which yet, by participating of that Motion of their Heads which they had at the Beginning, they continue eaſily to move along with their Heads thro' the Celeſtial Regions. And from hence it may again be concluded, That the Heavens are filled with no Matter that hath any Power of Remittance or Reſiſtance in it; ſince not only the Planets and Comets themſelves, but even ſuch very rare Bodies as the Tails of Comets, can both move there very freely and ſwiftly, and alſo continue that Motion for a vaſt while together.

This excellent Author ſuppoſes the Aſcent of Vapours into the Tails of Comets, to be cauſed by the Rarefaction of the Matter in the Atmoſphere, at the time of the Perihelion. Smoak, ſaith he, in a Chimney, aſcends up by the Impulſe of the Air in which it ſwims or floats: And Air, rarefy'd by Heat, aſcends by the Diminution of its ſpecifick Gravity, taking the Smoak, and carrying it up along with it. Why ſhould not the Tail of a Comet be, after the ſame manner, ſuppoſed to be raiſed by the Sun? For the Sun-beams do not agitate any Mediums which they paſs thro', but only by Reflexion and Refraction. The reflecting Particles being made warm by this Action, do warm the Æther, with which they are compounded. This Æther (or whatever you will call it) being rarefied by the Heat communicated to it, and having its ſpecifick Gravity, by which it deſcendeth toward the Sun before, now diminiſhed by this Refraction, aſcends, and carries along with it thoſe reflecting Particles of which the Tail of a Comet is compoſed.

To the Aſcent of theſe Vapours, it conduces, that they are carried by a circular Motion round the Sun, and conſequently endeavour to recede from the Sun, while the Atmoſphere of the Sun, and the Matters of the Heavens, doth either really reſt, or elſe, being moved with no other Motion than what they have from the Sun's Circumrotation, are moved very ſlowly. Theſe are the Cauſes of the Aſcent of Vapours into the Tails of Comets, when they are within the Confines of the Sun, where their Orbits are more curved, and where Comets being within the denſer, and therefore heavier Atmoſphere of the Sun, have their Tails of the greateſt Length. For the Tails which are now produced by preſerving their own Motion, and at the ſame with gravitating towards the Sun, will move about him in Ellipſes like their Heads, and by that Motion will always accompany, and freely adhere to their Head : For the Gravity of the Vapours towards the Sun, will no more cauſe the Tails of the Comets to forſake their Heads, and to fall down towards the Sun, than the Gravity of the Heads can make them fall off from their Tails. But by their common Gravity, they would either fall down to the Sun together, or be together retarded in their Aſcent ; and therefore this Gravity doth by no means hinder, but that the Heads and Tails of Comets may receive and retain any Poſition to one another, which either the above mentioned Cauſes, or any other may produce.

Theſe Tails therefore which are thus produced in the Perihelions of Comets, will go off along with their Heads into remotely diſtant Regions, and from thence, either with the Comets themſelves, return again to us after a long Series of Years ; or rather, being there rarefied, vaniſh quite away by little and little : For afterwards, in the Deſcent of their Heads towards the Sun, ſome little ſhort Tails ought gradually and ſlowly to be produced from the Heads, which afterwards, in the Perihelions of ſuch Comets, deſcend down into the Sun's Atmoſphere, muſt needs be immenſely encreaſed ; for the Vapours in thoſe free Spaces will continually be rarefied and dilated, whence it comes to paſs, that the Extremity of the Tail is always much broader than the End next to the Head of the Comet.

And it appears agreeable enough to Reaſon, to ſuppoſe, that thoſe Vapours which are thus dilated, rarefied and diffuſed throughout all the Celeſtial Regions, may, by little and little, by their own proper Gravity, be attracted down to the Planets, and become intermingled with their Atmoſpheres. For as to the Conſtitution of this Earth of ours, it is neceſſarily required that there ſhould be Seas, that from them vaſt Quantities of Vapours being raiſed by the Heat of the Sun, they may either gather into Clouds, and then fall down in Rain to moiſten and nouriſh the whole Earth, and to render it fertile ; or elſe (as ſome Philoſophers think with good Reaſon) being condenſed by the cold Tops of Mountains and Hills, run down from thence, and form Springs, Fountains, and Rivers ; ſo for the Conſervation of the Seas, and Moiſture of the Planets, Comets ſeem neceſſarily requiſite ; from whoſe condenſe Exhalations and Vapours, all that Moiſture which is conſumed in Vegetations and Putrefactions, and turned into dry Earth, may by degrees, be continually re-ſupplied and recruited : For all Vegetables do entirely grow and increaſe from Liquors ; and then, as to their greateſt Part, do turn by Putrefaction into dry Earth, and a Slime perpetually is precipitated to the Bottom of putrifying Liquors. From hence the Quantity or Bulk of dry Earth muſt continually increaſe, and the Liquors or Moiſture of our Globe continually decreaſe, and at laſt be quite evaporated and loſt, if they had not as continual a Supply from ſome Part or other of the Univerſe. And I do alſo ſuſpect (ſaith our Author) that that Spirit which is the fineſt, ſubtileſt, and beſt Part of our Air, and which is neceſſarily requiſite to the Life and Being of all things, comes chiefly from Comets.

The Atmoſphere of Comets, as they deſcend towards the Sun, are ſenſibly diminiſhed by their running out to afford Matter to produce the Tail, and (certainly in that Part which looks towards the Sun) do grow more narrow and contracted ; but after this, as the Comets recede from the Sun, when they do not ſo much run out into the Tail, they are enlarged, if *Hevelius* hath rightly obſerved the Phænomena. But they appear leaſt of all when the Heads of the Comets, having been ſo exceedingly heated by the Sun (in the Comet's Perihelia) blaze out into thoſe vaſtly great and bright ſhining Tails, and when the *Nuclei* being perhaps covered with a black, thick Smoak, are covered by the lower Parts of the Atmoſphere ; for all Smoak is greater, and more black and thick, when the Heat is very great.

Thus the Head of that Comet of which we have been ſpeaking, at equal Diſtances from the Sun and the Earth, appeared more obſcure after the Perihelion than before. For in *December* it appeared but like a Star of the Third Magnitude, whereas in *November* it was like one of the Firſt or Second.

He concludes therefore, that Comets are a kind of Planets moving round the Sun in very excentrical Orbits ; and as thoſe Planets which are neareſt the Sun, and revolve about him in leſſer Orbits, are leſſer than others, ſo he ſuppoſes thoſe Comets, which in their Perihelion come very near the Sun, are leſs than others, and revolve in leſſer Orbits.

If a Comet, in its Deſcent to, or Aſcent from, the Sun, approach near to the Planet as it paſſes by, and its Plane be different from that in which the Planets move : By its attractive Power it will, agreeably to the univerſal Law of Gravitation of Bodies, draw it from the Plane in which it before moved, and ſo cauſe it afterward to move to a new one, inclined to the former, but paſſing thro' the Sun as the former did:

Hence 'tis poſſible, That tho' the Planets originally revolved in the ſame common Plane, yet by the ſubſequent Attraction of Comets, their Planes may be inclined to one another, and different, as 'tis certain, *de facto*, they now are.

Dr. *Gregory*, in his *Aſtronom. Phyſ. & Geometr. Lib.* 5. ſhews, That the ancient Aſtronomers and Philoſophers believed Comets to be very eccentrical Planets revolving round the Sun ; and that it was the *Peripatetick* School which brought up the Notion of their being nothing but Meteors, and below the Moon.

Caſſini obſerv'd of the Comet which appear'd in the Year 1680, that it was but 22 or 23 Degrees from the Sun, and yet to us appeared to have Half its Globe illuminated, or not to be either falcated or gibbous ; which alſo was obſerved of the Comet in the Month of *April*, 1665 ; and from thence he concludes juſtly, That thoſe Comets were at that time not only higher than the Moon, but alſo, than the Sun himſelf ; becauſe *Mercury* and *Venus*, at that Diſtance from the Sun, do never appear full but when they are ſo.

The ſame Perſon thinks it is too raſh in the modern Philoſophers, to condemn, as falſe and ridiculous, the Notion that hath been long received of the bad Preſages of Comets ; for he ſaith, If the Tail of a Comet ſhould be intermingled with our Atmoſphere, or if the Matter of it ſhould, by its Gravity, fall down upon our Earth, it may induce Changes in our Air, that may be very ſenſible among Animal and Vegetable Bodies. *Aſtronom. p.* 408.

And, *p.* 412. he ſhews the way of determining the Way and apparent Place of a Comet. And, *p.* 418. from four obſerv'd Places of a Comet to determine its Trajectory, if it were Rectilineal.

And at *p.* 421. he gives the Method of determining the true Trajectory of a Comet. At *p.* 446. he ſhews how to find the Poſition of the Bodies of a Comet's Orbit, and when the Comet will be in them. And, *p.* 447. to find the Inclination of the Plane of the Comet's Orbit to that of the Ecliptick. And after this, he ſhews how to correct the Trajectory, and to determine the Heliocentrick and Geocentrick Place of the Comet in the Trajectory, determined by the Method before given, for any given Time; as alſo, to make neceſſary Tables for readily finding the Places of Comets. From *p.* 448, to *p.* 460.

The famous *James Bernouli*, in his *Syſtema Cometorum*, *An.* 1682. ſuppoſes, That there is ſome primary Planet revolving round the Sun in the Space of 4 Years and 157 Days, and at the Diſtance from him of 2583 Semi-diameters of the *Magnus Orbis*: The primary Planet he ſuppoſes, either from his vaſt Diſtance or Smallneſs, not to be viſible to us, but however, to have, at various Diſtances from him, ſeveral Satellites moving round him (tho' none deſcending ſo low as the Orbit of *Saturn*); and that theſe becoming viſible to us, when they are in their *Perigæum*, are what we call *Comets*.

See *Caſſini*'s Diſſertation in the Memoirs of the *French Academy of Sciences*, 1699.

In the *Act. Erud. Lipſ.* May 1682. there is a Way of finding the Diſtance of a Comet from the Earth, by *P. M. Kavina*, Mathematick Profeſſor of *Faenza*: And another in *December*, 1685. by *G. S. D.* whereby the Comet's Diſtance from the Earth is found, without any Change of Place or Station of the Obſervator, or taking any Altitudes or Azimuths.

Writers on the Subject of Comets.

Lubinietski Theatrum Cometicum. Cum Fig. 2 *Vol.* Amſt. 1661.
Johan. Hevelii Cometographia. Geduni, 1668.
———*Ejuſdem Prodromus Cometicus*, 1660
Eraſmus Bartholinus de Cometis.
Staniſlai Theatrum Cometicum.
Gattus de Cometis.
Jac. Bernouilli Conamen Novi Syſtematis Cometarum.
Diſſertation ſur le Nature des Cometes, per M. Petit.

Mr. Edmund Halley, *Savilian Profeſſor of* Geometry *in* Oxon. *and* F. R. S. *his* Synopſis of the Aſtronomy of Comets *is as follows*:

The ancient *Egyptians* and *Chaldeans*, (if we may credit *Diodorus Siculus*) by a long Courſe of Obſervations, were able to predict the Apparitions of Comets. But ſince they are alſo ſaid, by the Help of the ſame Arts, to have prognoſticated Earthquakes and Tempeſts; 'tis paſt all Doubt, That their Knowledge in theſe Matters was the Reſult rather of mere Aſtrological Calculation, than of any Aſtronomical Theories of the Cœleſtial Motions. And the *Greeks*, who were the Conquerors of both thoſe People, ſcarce found any other ſort of Learning amongſt them than this; ſo that it is to the *Greeks* themſelves as the Inventors (and eſpecially to the great *Hipparchus*) that we owe this Aſtronomy, which is now improved to ſuch a Height. But yet, amongſt theſe, the Opinion of *Ariſtotle* (who wou'd have Comets to be nothing elſe but ſublunary Vapours, or airy Meteors) prevailed ſo far, that this moſt difficult Part of the Aſtronomical Science lay altogether neglected; for no body thought it worth while to take Notice of, or write about the wandring uncertain Motions of what they eſteemed Vapours floating in the Æther; whence it came to paſs, that nothing certain concerning the Motion of Comets, can be found tranſmitted from them to us.

But *Seneca* the Philoſopher, having conſidered the Phænomena of two remarkable Comets of his Time, made no Scruple to place them amongſt the Cœleſtial Bodies, believing them to be Stars of equal Duration with the World, tho' he owns their Motions to be governed by Laws, not as then known or found out. And at laſt (which was no untrue or vain Prediction) he foretells, That there ſhould be Ages ſome time hereafter, to whom Time and Diligence ſhould unfold all theſe Myſteries; and who ſhould wonder, that the Ancients could be ignorant of them, after ſome lucky Interpreter of Nature had ſhewn, *in what Parts of the Heavens the Comets wander'd, what, and how great they were.* Yet almoſt all the Aſtronomers differ'd from this Opinion of *Seneca*; neither did *Seneca* himſelf think fit to ſet down theſe Phænomena of the Motion, by which he was enabled to maintain his Opinion, nor the Times of thoſe Appearances which might be of Uſe to Poſterity, in order to the determining theſe things. And indeed, upon the turning over very many Hiſtories of Comets, I find nothing at all that can be of Service in this Affair, before *An. Dom.* 1337. at which time, *Nicephorus Gregorius*, a *Conſtantinopolitan* Hiſtorian and Aſtronomer, did pretty accurately deſcribe the Path of a Comet amongſt the fix'd Stars, but was too lax as to the Account of the Time; ſo that this moſt doubtful and uncertain Comet only deſerves to be inſerted in our Catalogue for the ſake of its appearing near 400 Years ago.

Then the next of our Comets was in the Year 1472, which being the ſwifteſt of all, and neareſt to the Earth, was obſerved by *Regiomontanus*: This Comet (ſo frightful upon the Account both of the Magnitude of its Body and the Tail) moved 40 Degrees of a great Circle in the Heavens in the Space of one Day, and was the firſt of which any proper Obſervations are come down to us: But all thoſe that conſidered Comets, until the Time of *Tycho Brahe* (that great Reſtorer of Aſtronomy) believed them to be below the Moon, and ſo took but little Notice of them, reckoning them not other than Vapours.

But in the Year 1577 (*Tycho* ſeriouſly purſuing the Study of Stars, and having gotten large Inſtruments for the performing Cœleſtial Menſurations, with far greater Care and Certainty than the Ancients could ever hope for) there appeared a very remarkable Comet; to the Obſervation of which, *Tycho* vigorouſly applied himſelf, and found, by many juſt and faithful Trials, that it had not a Diurnal Parallax that was at all perceptible; and conſequently was not only no aereal Vapour, but alſo much higher than the Moon; nay, might be placed amongſt the Planets for any thing that appeared to the contrary: The cavilling Oppoſition made by ſome of the School-men in the mean time being to no Purpoſe.

Next to *Tycho* came the ſagacious *Kepler*. He having the Advantage of *Tycho*'s Labours and Obſervations, found out the true Phyſical Syſtem of the World, and vaſtly improv'd the Aſtronomical Science.

For he demonſtrated, that the Planets perform their Revolutions in *Elliptick Orbits, whoſe Planes paſs thro' the Centre of the Sun,* obſerving this Law, *That the Areas* (*of the Elliptick Sectors, taken at the Centre of the Sun, which he proved to be in the common Focus of theſe Ellipſes*) *are always proportional to the Times in which the correſpondent Elliptical Arches are deſcribed.* He diſcover'd alſo, *That the Diſtances of the Planets from the Sun are in the* Seſquialteral Ratio *of the Periodical Times, or* (which is all one) *That the Cubes of the Diſtances are as the Squares of the Times.* This great Aſtronomer had the Opportunity of obſerving two Comets, one of which was a very remarkable one. And from the Obſervations of theſe (which afforded ſufficient Indications of an *Annual Parallax*) he concluded, *That the Comets mov'd freely thro' the Planetary Orbs, with a Motion not much different from a Rectilinear one; but of what kind he could not then preciſely determine.*

Next, *Hevelius* (a noble Emulator of *Tycho Brahe*) following in *Kepler*'s Steps, embraced the ſame Hypotheſis of the *Rectilinear Motion of Comets,* himſelf accurately obſerving many of them; yet he complained, that his Calculations did not agree to the Matter of Fact in the Heavens: And was aware, *That the Path of a Comet was bent into a Curve-Line towards the Sun.* At length came that prodigious Comet of the Year 1680, which deſcending, as it were, from an infinite Diſtance perpendicularly towards the Sun, aroſe from him again with as great a Velocity.

This Comet, which was ſeen for four Months continually, by the very remarkable and peculiar Curvity of its Orbit (above all others) gave the fitteſt Occaſion for inveſtigating the *Theory of their Motion.* And the *Royal Obſervatories* of *Paris* and *Greenwich* having been for ſome time founded and committed to the Care of the *moſt excellent Aſtronomers,* the apparent Motion of this Comet was moſt accurately (perhaps as far as human Skill could go) obſerv'd by Meſſieurs *Caſſini* and *Flamſteed.*

Not long after that *great Geometrician,* the illuſtrious Sir *Iſaac Newton,* writing his *Mathematical Principles of Natural Philoſophy,* demonſtrated not only, that what *Kepler* had found did neceſſarily obtain in the *Planetary Syſtem,* but alſo, that all the Phænomena of Comets would naturally follow from the ſame Principles; which he abundantly illuſtrated by the Example of the aforeſaid Comet of the Year 1680, ſhewing, at the ſame time, a Method of delineating the Orbits of Comets geometrically; wherein he (not without the higheſt Admiration of all Men) ſolv'd a Problem, whoſe Intricacy render'd it worthy of himſelf. This Comet he proved to move round the Sun in a parabolical Orb, and to deſcribe Area's (taken at the Centre of the Sun) proportional to the Times.

Wherefore (following the Steps of ſo great a Man) I have attempted to bring the ſame Method to Arithmetical Calculation; and that with deſired Succeſs. For having collected all the Obſervations of Comets I could, I framed this Table, the Reſult of a prodigious Deal of Calculation; which, tho' but ſmall in Bulk, will be no unacceptable Preſent to Aſtronomers. For theſe Numbers are capable of repreſenting all that has been yet obſerved about the Motion of Comets, by the Help of the following General Table; in the making of which I ſpared no Labour, that it might come forth perfect, as a Thing conſecrated to Poſterity, and to laſt as long as Aſtronomy itſelf.

The Aſtronomical Elements of the Motions, in a Parabolick Orb, of all the Comets that have been duly hitherto obſerved.

Comet, Anno	Nodus Aſcend.	Inclin. Orbitæ.	Perihelion.	Diſt. Perihelii a Sole.	Log. Diſt. Perihelii a Sole.	Temp. equat. Perihelii.	Perihelion a Node.	
	gr. ′ ″	*gr* ′ ″	*gr.* ′ ″			*d. h.* ′	*gr.* ′ ″	
1337	♊24.21. 0	32.11. 0	♉ 7.59. 0	40666	9,609236	*June* 2. 6.25	46.22. 0	Retrog.
1472	♑11.46.20	5.20. 0	♉15.33.30	54273	9,734584	*Febr.* 28.22.23	123.47.10	Retrog.
1531	♉19.25. 0	17.56. 0	♒ 1.39. 0	56700	9,753583	*Auguſt* 24.21.18½	107.46. 0	Retrog.
1532	♊20.27. 0	32.36. 0	♋21. 7. 0	50910	9,706803	*October* 12.22.12	30.40. 0	Direct.
1556	♍25.42. 0	32. 6.30	♑ 8.50. 0	46390	9,666424	*April* 21.20. 3	103. 8. 9	Direct.
1577	♈25.52. 0	74.32.45	♌ 9.22. 0	18342	9,263447	*October* 26.18.45	103.30. 0	Retrog.
1580	♈18.57.20	64.40. 0	♋19. 5.50	59628	9,775450	*Nov.* 28.15. 0	90. 8.30	Direct.
1585	♉ 7.42.30	6, 4. 0	♈ 8.51. 0	109358	38850	*Sept.* 27.19.20	28.51.30	Direct.
1590	♍15.30.40	29.40.40	♏ 6.54.30	57661	9,660882	*Jan.* 29. 3.45	51.23.50	Retrog.
1596	♒12.12.30	55.12. 0	♏18.16. 0	51293	9,710058	*July* 31.19.55	83.56.30	Retrog.
1607	♉20.21. 0	17. 2. 0	♒ 2.16. 0	58680	9,768490	*October* 16. 3.50	108. 5. 0	Retrog.
1618	♊16. 1. 0	37.34. 0	♈ 2.14. 0	37975	9,579498	*October* 29.12.23	73.47. 0	Direct.
1650	♊28.10. 0	79.28. 0	♈28.18.40	84750	9,928140	*Nov.* 2.15.40	59.51.20	Direct.
1661	♊22.30.30	32.35.50	♋25.58.40	44851	9,651772	*Jan.* 16.23.41	33.28.10	Direct.
1664	♊21.14. 0	21.18.30	♌10.41.25	102575½	11044	*Nov.* 24.11.52	59.27.25	Retrog.
1665	♐18. 2. 0	76. 5. 0	♊11.54.30	10649	9,027309	*April* 14. 5.15½	156. 7.30	Retrog.
1672	♑27.30.30	83.22.10	♉16.59.30	69739	9,843476	*Febr.* 20. 8.37	109.29. 0	Direct.
1677	♏26.49.10	79. 3.15	♌17.37. 5	28059	9,448072	*April* 26. 0.37½	99.12. 5	Retrog.
1680	♑ 2. 2. 0	60.56. 0	♐22.39.30	612½	7,787106	*Dec.* 8. 0. 6.	9.22.30	Direct.
1682	♉21.16.30	17.56. 0	♏ 2.52.45	58328	9,765877	*Sept.* 4. 7.39	108.23.45	Retrog.
1683	♍23.23. 0	83.11. 0	♊25.29.30	56020	9,748343	*July* 3. 2.50	87.53.30	Retrog.
1684	♐28.15. 0	65.48.40	♏28.58. 0	96015	9,982339	*Maii* 29.10.16	29.23. 0	Direct.
1686	♓20.34.40	31.21.40	♊17. 0.30	302500	9,511883	*Sept.* 6.14.33	86.25.50	Direct.
1698	♐27.44.10	11.46. 0	♑ 0.51.15	309129	9,839660	*October* 8.16.57	3. 7. 0	Retrog.

This Table needs little Explication, ſince 'tis plain enough from the Titles, what the Numbers mean: Only it may be obſerved, that the Perihelium Diſtances are eſtimated in ſuch Parts, as the middle Diſtances of the Earth from the Sun contains 100000.

A General

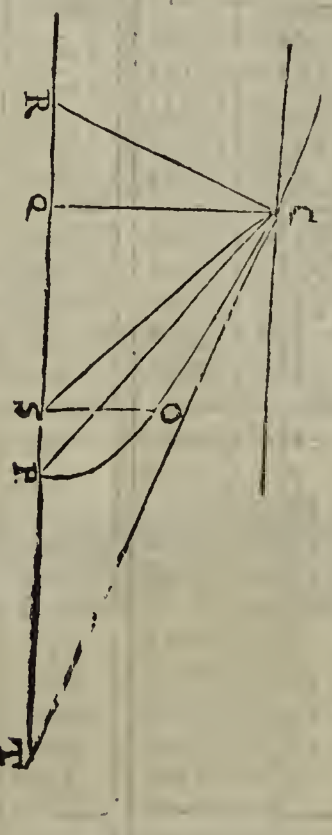
A General Table *for Calculating the Motions of Comets in a Parabolick Orbit.*

Med. mot.	Ang. a Perihelio.	Logar. pro diſt. a Sole.	Med. mot.	Ang. a Perihelio.	Logar. pro diſt. a Sole	Med. mot.	Ang. a Perihelio.	Logar. pro diſt. a Sole.	Med. mot.	Ang. a Perihelio.	Logar. pro diſt. a Sole.
	gr. ′ ″			gr. ′ ″			gr. ′ ″			gr. ′ ″	
1	1 31 40	0.000077	61	69 55 58	0.172914	142	102 32 41	0.407380	360	127 28 6	0.708104
2	3 3 15	0.000309	62	70 36 56	0.176557	144	103 0 31	0.411784	370	128 2 33	0.716976
3	4 34 43	0.000694	63	71 17 16	0.180188	146	103 27 47	0.416132	380	128 35 38	0.725606
4	6 6 0	0.001231	64	71 56 56	0.183803	148	103 54 31	0.420430	390	129 7 27	0.734006
5	7 37 1	0.001921	65	72 35 57	0.187404	150	104 20 43	0.424670	400	129 38 4	0.742186
6	9 7 43	0.002759	66	73 14 15	0.190978	152	104 46 22	0.428866	410	130 7 34	0.750160
7	10 38 2	0.003745	67	73 51 59	0.194540	154	105 11 33	0.433012	420	130 36 2	0.757930
8	12 7 54	0.004876	68	74 29 6	0.198085	156	105 36 16	0.437110	430	131 3 30	0.765516
9	13 37 17	0.006151	69	75 5 38	0.201614	158	106 0 32	0.441164	440	131 30 2	0.772918
10	15 6 7	0.007564	70	75 41 35	0.205122	160	106 24 23	0.445178	450	131 55 41	0.780148
11	16 34 20	0.009115	71	76 16 56	0.208612	162	106 47 47	0.449144	460	132 20 30	0.787216
12	18 1 54	0.010798	72	76 51 43	0.212080	164	107 10 44	0.453060	470	132 44 32	0.794122
13	19 28 47	0.012609	73	77 25 57	0.215529	166	107 33 17	0.456936	480	133 37 50	0.800882
14	20 54 54	0.014550	74	77 59 41	0.218963	168	107 55 27	0.460772	490	133 0 25	0.807494
15	22 20 14	0.016607	75	78 32 54	0.222378	170	108 17 14	0.464208	500	133 52 20	0.813969
16	23 44 44	0.018783	76	79 5 35	0.225769	172	108 38 37	0.468318	520	134 34 18	0.826522
17	25 8 22	0.021072	77	79 37 45	0.229142	174	108 59 39	0.472030	540	135 14 0	0.838600
18	26 31 8	0.023470	78	80 9 23	0.232488	176	109 20 20	0.475705	560	135 51 28	0.850187
19	27 52 55	0.025969	79	80 40 34	0.235809	178	109 40 40	0.479340	580	136 27 6	0.861369
20	29 13 47	0.028570	80	81 11 16	0.239127	180	110 0 40	0.482937	600	137 0 57	0.872155
21	30 33 40	0.031263	81	81 41 34	0.242416	182	110 20 20	0.486498	620	137 33 13	0.882575
22	31 52 32	0.034045	82	82 11 19	0.245684	184	110 39 41	0.490022	640	138 3 58	0.892649
23	33 10 23	0.036916	83	82 40 40	0.248933	186	110 58 44	0.493512	660	138 33 21	0.902401
24	34 27 12	0.039864	84	83 9 34	0.252159	188	111 17 28	0.496965	680	139 1 29	0.911866
25	35 42 59	0.042892	85	83 38 4	0.255366	190	111 35 55	0.500484	700	139 28 25	0.927012
26	36 57 41	0.045982	86	84 6 8	0.258552	192	111 54 5	0.503769	720	139 54 16	0.929907
27	38 11 20	0.049154	87	84 33 49	0.261720	194	112 11 58	0.507121	740	140 19 5	0.938549
28	39 23 54	0.052382	88	85 1 5	0.264865	196	112 29 34	0.510441	760	140 42 56	0.946951
29	40 35 23	0.055668	89	85 27 58	0.267989	198	112 46 55	0.513729	780	141 5 55	0.955124
30	41 45 47	0-059009	90	85 54 27	0.271092	200	113 4 0	0.516984	800	141 28 3	0.963082
31	42 55 6	0.062400	91	86 20 34	0.274076	204	113 37 25	0.523406	820	141 49 24	0.970837
32	44 3 20	0.065838	92	86 46 20	0.277239	208	114 9 52	0.529705	840	142 10 0	0.978397
33	45 10 29	0.069319	93	87 11 43	0.280287	212	114 41 23	0.535886	860	142 29 56	0.985771
34	46 16 35	0.072839	94	87 36 45	0.283306	216	115 12 2	0.541958	880	142 49 10	0.992970
35	47 21 36	0.076396	95	88 1 27	0.286308	220	115 41 51	0.547922	900	143 7 48	0.100000
36	48 25 33	0.079984	96	88 25 49	0.289293	224	116 10 52	0.553782	920	143 25 51	1.006871
37	49 28 27	0.083600	97	88 49 48	0.292252	228	116 39 7	0.559538	940	143 43 21	1.013586
38	50 30 19	0.087244	98	89 13 32	0.295201	232	117 6 38	0.565199	960	144 0 18	1.020155
39	51 31 8	0.090910	99	89 36 54	0.298122	236	117 33 27	0.570762	980	144 16 46	1.026583
40	52 30 56	0.094569	100	90 0 0	0.301030	240	117 59 35	0.576233	1000	144 32 46	1.032876
41	53 29 44	0.098300	102	90 45 14	0.306782	244	118 25 5	0.581616	1500	149 26 8	1.158188
42	54 27 32	0.102019	104	91 29 18	0.307469	248	118 49 57	0.586912	2000	152 26 15	1.246058
43	55 24 21	0.105742	106	92 12 14	0.318060	252	119 14 14	0.592122	2500	154 32 20	1.313703
44	56 20 12	0.109490	108	92 54 4	0.323587	256	119 37 56	0.597252	3000	156 7 27	1.368678
45	57 15 6	0.113240	110	93 34 52	0.329042	260	120 1 6	0.602301	3500	157 22 19	1.414974
46	58 9 0	0.116995	112	94 14 40	0.334424	264	120 23 44	0.607274	4000	158 24 36	1.454950
47	59 2 4	0.120756	114	94 53 30	0.339736	268	120 45 52	0.612174	4500	159 16 36	1.490125
48	59 54 11	0.124518	116	95 31 22	0.344979	272	121 7 30	0.616998	5000	160 1 12	1.521521
49	60 45 25	0.128278	118	96 8 22	0.350153	276	121 28 39	0.621750	5500	160 40 5	1.549864
50	61 35 45	0.132035	120	96 44 30	0.355262	280	121 49 22	0.626438	6000	161 14 24	1.575718
51	62 25 14	0.135792	122	97 19 48	0.360306	284	122 1 38	0.631056	6500	161 45 0	1.599460
52	63 13 52	0.139544	124	97 54 17	0.365284	288	122 29 28	0.635608	7000	162 12 34	1.621417
53	64 1 40	0.143291	126	98 28 0	0.370200	292	122 48 54	0.640098	7500	162 37 34	1.641838
54	64 48 38	0.147029	128	99 0 37	0.375052	296	123 7 57	0.644525	8000	163 0 23	1.660922
55	65 34 50	0.150762	130	99 33 11	0.379842	300	123 26 36	0.648393	8500	163 21 20	1.678834
56	66 20 13	0.154482	132	100 4 43	0.384576	310	124 11 40	0.659559	9000	163 40 42	1.695703
57	67 4 50	0.158102	134	100 35 45	0.389252	320	124 54 36	0.669880	9500	163 58 38	1.711662
58	67 58 42	0.161890	136	101 5 48	0.393868	330	125 35 34	0.679876	10000	164 15 20	1.726784
59	68 31 50	0.165578	138	101 35 22	0.398428	340	126 14 44	0.689578	50000	170 52 0	2.197960
60	69 14 16	0.169254	140	102 4 19	0.402930	350	126 52 12	0.698970	100000	172 45 44	2.399655

The Conſtruction and Uſe of the General Table.

As the Planets move in Elliptical Orbs, ſo do the Comets in Parabolick ones, having the Sun in their common Focus, and deſcribe equal Area's in equal Times. But now, becauſe all Parabola's are ſimilar to one another; therefore, if any determinate Part of the Area of a given Parabola be divided into any Number of Parts at Liberty, there will be a like Diviſion made in all Parabola's, under the ſame Angles, and the Diſtances will be proportional: And conſequently this one Table of ours will ſerve for all Comets. Now, the manner of the Calculation of this Table is thus: In the Fig. let S be the Sun, P O C the Orbit of a Comet, P the Perihelion, O the Place where the Comet is 90 *gr.* diſtant from the Sun, C any other Place. Draw the Right-lines C P, C S, and make S T, S R, equal to C S, and then having drawn the Right-lines, C R, C T, (whereof the one is a Tangent, and the other a Perpendicular, to the Curve) let fall C Q perpendicular to the Axis P S R.

Now, any Area, as C O P S, being given, 'tis requir'd to find the Angle C S P, and the Diſtance C S. From the Nature of the Parabola, R Q is ever $= \frac{1}{2}$ the Parameter of the Axis, and conſequently if the Parameter be put = 2, then R Q = 1. Let C Q equal z; then P Q ſhall $= \frac{1}{2} z z$, and the Parabolick Segment C O P $= {}_{1}\frac{1}{2}\, z z z$. But the Triangle C S P will $= \frac{1}{4} z$; and ſo the Mixtilineal Area C O P S $= {}_{1}\frac{1}{2}\, z^{3} + \frac{1}{4} z = a$; whence $z^{3} + 3\, x = 12\, a$. Wherefore reſolving this Cubical Equation, z, or the ordinate C Q, will be known. Now, let the Area O P S be propos'd



to be divided into 100 Parts; this Area is ${}_{1}\frac{1}{2}$ of the Square of the Parameter; and conſequently 12 a is = equal that Square = 4. If therefore the Roots of theſe Equations $z_{3} + 3\, z = 0{,}\,04 : 0{,}\,08 : 0{,}\,12 : 0{,}\,16$, *&c.* be ſucceſſively extracted, there will be obtain'd ſo many z, or Ordinates C Q, reſpectively, and the Area S O P will be divided into 100 Parts. And in like manner is the Calculus to be continued beyond the Place O. Now the Root of this Equation (ſince R Q is = 1) is the Tabular Tangent of the Angle C R Q, or Half the Angle C S P; and ſo the Angle C S P is given. And R C, the Secant of the Same Angle C R Q, is a mean Proportional between R Q or Unity; and R T, which is the Double of S C, as is plain from the Conicks. But if S P be put = 1, and ſo the *Latus Rectum* = 4, (as in our Table) then R T will be the Diſtance ſought, *viz* the Double of S C in the former Parabola. After this manner therefore I compos'd the foregoing Table, which ſerves to repreſent the Motions of all Comets: For hitherto there has been none obſerv'd, but comes within the Laws of the Parabola.

It remains now, that we give the Rules for the Calculation, and ſhew the way of determining the Place of a Comet ſeen, by thoſe Numbers. The Velocity of a Comet moving in a Parabola, is every where to the Velocity of a Planet deſcribing a Circle about the Sun, at the ſame Diſtance from the Sun, as $\surd\, 2$ to 1, as appears from *Cor.* VII. *Prop.* 16. *Lib.* 1. of the *Princip. Phil. Nat. Math.* If therefore a Comet in its Perihelium were ſuppoſed to be as far diſtant from the Sun as the Earth is, then the Diurnal Area which the Comet wou'd deſcribe, would be to the Diurnal Area of the Earth, as $\surd\, 2$ to 1: And conſequently, the Time of the annual Revolution, is to the Time in which ſuch a Comet wou'd deſcribe a Quadrant of its Orbit from the Perihelium, as 314159, *&c.* (that is, the Area of the Circle) to $\surd\, \frac{8}{9}$. Therefore the Comet wou'd deſcribe that Quadrant in 109 Days, 14 Hours, 46 Minutes; and ſo that Parabolick Area (analogous to the Area P O S) being divided into 100 Parts, to each Day there would be allotted 912280 of thoſe Parts; the Log. of which, *viz.* 9.960128, is to be kept for continual Uſe. But then, the Times in which a Comet, at a greater or leſs Diſtance, would deſcribe ſimilar Quadrants, are as the Times of the Revolutions in Circles, that is, in the Seſquiplicate Ratio of the Diſtances: And ſo the Diurnal Area's, eſtimated in the Centeſimal Parts of the Quadrant (which Parts we put for Meaſures of the Mean Motion, like Degrees) are in each in the Subſeſquialteral Proportion of the Diſtance from the Sun in the Perihelion.

Theſe neceſſary things premis'd, let it be propos'd to compute the apparent Place of any one of the mention'd Comets for any given Time. Therefore,

1. *Let the Sun's Place be had, and the Log. of its Diſtance from the Earth.*

2. *Let the Difference between the Time of the Perihelion, and the Time given, be gotten in Days and Decimal Parts of Days. To the Log. of this Number, let there be added to the conſtant Log.* 9.960121, *and the Complement Arithmetical of the* $\frac{3}{2}$ *of the Log. of the Diſtance in the Perihelium from the Sun: The Sum will be the Log. of the Mean Motion, to be ſought in the firſt Column of the General Table.*

3. *With the Mean Motion let there be taken the correſpondent Angle from the Perihelium, in the Table, and the Log. for the Diſtance from the Sun: Then in Comets that are direct, add, and in retrograde ones, ſubtract, if the Time be after the Perihelium, the Angle thus found, to or from the Place of the Perihelium; or in direct Comets, ſubtract, and in retrograde ones add, if the Time be before the Perihelium, the foreſaid Angle to or from the Place of the Perihelium; and ſo we ſhall have the Place of the Comets in its Orbit. And to the Log. found for the Diſtance, let there be added the Log. of the Diſtance*

Diſtance in the Perihelium, and the Sum will be the Log. of the true Diſtance of the Comet from the Sun.

4. *The Place of the Node, together with the Place of the Comet in its Orbit, being given, let the Diſtance of the Comet from the Node be found; then the Inclination of the Plane being given, there will be given alſo (from the common Rules of Trigonometry) the Comet's Place reduc'd to the Ecliptick, the Inclination or Heliocentrick Latitude, and the Log. of the curtate Diſtance.*

5. *From theſe things given (by the very ſame Rules that we find the Planet's Place from the Sun's Place and Diſtance given) we may obtain the Apparent or Geocentrick Place of the Comet, together with the Apparent Latitude.* And this it may be worth while to illuſtrate, by an Example or two.

Example I.

Let it be required to find the Place of the Comet of the Year 166$\frac{4}{5}$, March *the* 1d, 7h, 00′, *P. M.* London: *That is*, 96d, 19h, 8′, *after the Perihelium, which happened* Novemb. 24°, 11h, 52′.

Log. Diſt. Perihel.	0.011044
Log. Seſquialt.	0.016566
Comp. Arith.	9.983434
	9.960128
Log. Temp.	1.985862
Log. Med. Mot.	1.929424
Medius Motus	85.001
Perihel. ♌	10.41.25
Ang. Correſp.	83.38.05—
Comet. in Orb. ♉	17.03.20
Aſcend. Nod. ♊	21.14.00
Com. a Nodo	34.10.40
Red. ad Eclip.	32.19.05
Com. Helioc. ♉	18.54.55
Incl. Bor.	11.46.50
Log. pro diſt.	0.255369
Log. Perihel.	0.011044
Co-ſin Incl.	9.990754
Log. diſt. Curt.	0.257167
Log. diſt. ☉	9.997918
☉ ♓	21.44.45
Com. Viſus ♈	29.18.30
Lat. Viſa	8.36.15

Example II.

Let it be required to find the Place of the Comet of the Year 1683, July 23°, 13h, 35′, *P. M.* London: *Or*, 13h, 40′, *Equat. Time. That is*, 21d, 10h, 50′, *after the Perihelium.*

Log. diſt. Perihel.	9.748343
Log. Seſquialt.	2.622514
Comp. Arith.	0.377486
	9.960128
Log. Temp.	1.310723
Log. Med. Mot.	1.648337
Medius Motus	44.498
Perihel. ♊	25.29.30—
Ang. Correſp.	23.23.20
Comet. in Orb. ♈	28.42.10
Nod. Deſcend. ♓	23.23.00
Com. a Nodo	35.19.10
Red. ad Eclip.	4.48.30
Com. Helioc. ♓	28.11.30
Incl. Bor.	35.2.00
Log. pro diſt.	0.111336
Log. Perihel.	9.748343
Co-ſin. Incl.	9.913187
Log. diſt. Curt.	9.772866
Log. diſt. ☉	0.006104
☉ Locus ♌	10.41.25
Com. Viſus ♋	5.11.50
Lat. Bor.	28.52.00

At the Inſtant of Time ſpecified in the firſt Example, 'twas obſerved (at *London*) that the Comet applied to the ſecond Star of *Aries*; ſo that it was found to be 9′ more Northerly, and 3′ to the Eaſt, according to Mr. *Hook*'s Obſervation. But at that of the ſecond Example, I myſelf (near *London*, with the ſame Inſtruments whereby I formerly obſerved the Southern Conſtellations) found the Place of the Comet to be ♋, 5°. $11\frac{1}{2}$′, and 28°, 52′, North Latitude, which agreed exactly with the Obſervation made at *Greenwich* almoſt the very ſame Moment.

As for the Comet of the Year 1680, which came almoſt to the very Sun itſelf (being in its Perihelion, not above $\frac{1}{3}$ of the Semidiameter of the Sun, diſtant from the Surface of it, ſince the *Latus Rectum* is ſo very ſmall, could hardly be contained within the Limits of the General Table, becauſe of the exceſſive Velocity of the Mean Motion. Therefore, in this Comet, the beſt way is (after the Mean Motion is found) to get from thence (by the Help of the foregoing Equation $z^3 + 3z = \frac{4}{100}$, of the Mean Motion) the Tangent of Half the Angle from the Perihelion, together with the Log. for the Diſtance from the Sun. Which Things being given, we are to proceed by the ſame Rules as in the reſt.

After this manner therefore the Aſtronomical Reader may examine theſe Numbers, which I have calculated with all imaginable Care, from the Obſervations I have met with: And I have not thought fit to make them publick before they have been duly examined, and made as accurate as 'twas poſſible, by the Study of many Years. I have publiſhed this Specimen of Cometical Aſtronomy, as a Prodromus of a deſigned future Work; leſt happening to die, theſe Papers might be loſt, which every Man is not capable to retrieve, by reaſon of the great Difficulty of the Calculation.

Now, it may not be amiſs to put the Reader in mind, That our Five firſt Comets (the Third and Fourth obſerved by *Peter Apian*, the Fifth by *Paulus Fabricius*) as alſo the Tenth ſeen by *Mæſtiin*, if I miſtake not, in the Year 1580, are not ſo certain as the reſt; for the Obſervations were made neither with fit Inſtruments, nor due Care, and upon that Account are diſagreeing with themſelves, and can by no means be reconcil'd with a regular Computation. The Comet which appear'd in the

Year 1684, was only taken Notice of by *Blanchinus*, who obſerved at *Rome*. And the laſt, which appear'd in the Year 1698, was ſeen only by thoſe at *Paris*, who determined its Courſe in a very uncommon way. This Comet was very obſcure; and altho' it mov'd ſwift, and came near enough our Earth, yet we, who were wont to be curious enough in theſe Matters, ſaw nothing of it. For Want of Obſervations, I have left out of the foregoing Catalogue, thoſe two remarkable Comets which have appeared in this our Age; the one in *November*, in the Year 1698, and the other in *February*, in the Year 1702. For they directing their Courſes towards the Southern Parts of the World, and being ſcarce conſpicuous here in *Europe*, met with no Obſervers capable of the Buſineſs. But if any one ſhall bring from *India*, or the Southern Parts, an accurate Series of requiſite Obſervations, I will willingly fall to Work again, and undergo the Fatigue of repreſenting their Orbits in Numbers, as I have done the reſt.

By comparing together the Accounts of the Motions of theſe Comets, 'tis apparent their Orbits are diſpoſed in no manner of Order; nor can they, as the Planets are, be moved indifferently every way, as well retrograde as direct: From whence it is clear, they are not carried about, or moved in Vortices. Moreover, the Diſtances in their Periheliums are ſometimes greater, ſometimes leſs; which makes us ſuſpect there may be a far greater Number of them, which moving in Regions more remote from the Sun, become very obſcure; and wanting Tails, paſs by us unſeen.

Hitherto I have conſider'd the Orbits of Comets as exactly Parabolick; upon which Suppoſition it would follow, that Comets being impell'd towards the Sun by a Centripetal Force, deſcend as from Spaces infinitely diſtant; and by their Falls acquire ſuch a Velocity, as that they may again run off into the remoteſt Parts of the Univerſe, moving upwards with ſuch a perpetual Tendency, as never to return again to the Sun. But ſince they appear frequently enough, and ſince none of them can be found to move with an Hyperbolick Motion, or a Motion ſwifter than what the Comet might acquire by its Gravity to the Sun, 'tis highly probable they rather move in very Eccentrick Orbits, and make their Returns, after long Periods of Time: For ſo their Numbers will be determinate, and perhaps not ſo very great. Beſides, the Space between the Sun and the fix'd Stars is ſo immenſe, that there is Room enough for a Comet to revolve, tho' the Period of its Revolution be vaſtly long. Now the *Latus Rectum* of an Ellipſis, is to the *Latus Rectum* of a Parabola, which has the ſame Diſtance in its Perihelium, as the Diſtance in the Aphelium in the Ellipſis, is to the whole Axis of the Ellipſis; and the Velocities are in a ſubduplicate Ratio of the ſame: Wherefore in every Eccentrick Orbit, this Ratio comes very near to a Ratio of Equality; and the very ſmall Difference which happens on account of the greater Velocity in the Parabola, is eaſily compenſated in determining the Situation of the Orbit. The principal Uſe therefore of this Table of the Elements of their Motions, and that which induced me to conſtruct it, is, That whenever a new Comet ſhall appear, we may be able to know, by comparing together the Elements, whether it be any of thoſe which has appeared before, and conſequently to determine its Period, and the Axis of its Orbit, and to foretell its Return. And indeed there are many things which *Apian* obſerved in the Year 1531, were the ſame with that which *Kepler* and *Longomontanus* took Notice of, and deſcribed in the Year 1607, and which I myſelf have ſeen return, and obſerved in the Year 1682. All the Elements agree, and nothing ſeems to contradict this my Opinion, beſides the Inequality of the Periodick Revolutions: Which Inequality is not ſo great neither, as that it may not be owing to Phyſical Cauſes: For the Motion of *Saturn* is ſo diſturbed by the reſt of the Planets, eſpecially *Jupiter*, that the Periodick Time of that Planet is uncertain for ſome whole Days together. How much more therefore will a Comet be ſubject to ſuch like Errors, which riſes almoſt four times higher than *Saturn*, and whoſe Velocity, tho' increaſed but a very little, would be ſufficient to change its Orbit from an Elliptical to a Parabolical one. This, moreover, confirms me in my Opinion of its being the ſame; that in the Year 1456, in the Summer-time, a Comet was ſeen paſſing retrograde between the Earth and the Sun, much after the ſame manner: Which, tho' no body made Obſervations upon it, yet from its Perſon, and the manner of its Tranſit, I cannot think different from thoſe I have juſt now mentioned. Hence I dare venture to foretell, That it will appear again in the Year 1758. And if it ſhould then return, we ſhall have no Reaſon to doubt but that the reſt muſt return too: Therefore Aſtronomers have a large Field to exerciſe themſelves in for many Ages, before they will be able to know the Number of theſe many and great Bodies revolving about the common Centre of the Sun, and reduce their Motions to certain Rules. I thought indeed, that the Comet which appear'd in the Year 1532, might be the ſame with that obſerved by *Hevelius* in the Year 1661. But *Apian's* Obſervations, which are the only ones we have concerning the firſt of theſe Comets, are too rude and unskilful for any thing of Certainty to be drawn from them, in ſo nice a Matter. I deſign to treat of all theſe things in a larger Volume, and contribute my utmoſt for the Promotion of this Part of Aſtronomy, if it ſhall pleaſe God to continue my Life and Health.

In the mean time, thoſe that deſire to know how to conſtruct Geometrically the Orb of a Comet by three accurate Obſervations given, may find it at the End of the Third Book of Sir *Iſaac Newton's* Principles of Natural Philoſophy, intituled, *De Syſtemate Mundi*, in the Words of its renowned Inventor. Which have ſince been more fully explained by my very worthy Collegue, Dr. *Gregory*, in his learned Works of *Aſtronomia Phyſica & Geometrica*.

One thing more perhaps it may not be improper or unpleaſant to advertiſe the Aſtronomical Reader, That ſome of theſe Comets have their Nodes ſo very near the annual Orb of the Earth, that if it ſhall ſo happen, that the Earth be found in the Parts of her Orb next the Node of a Comet, whilſt the Comet paſſes by; as the apparent Motion of the Comet will be incredibly ſwift, ſo its Parallax will become very ſenſible; and the Proportion thereof, to that of the Sun, will be given. Wherefore ſuch Tranſits of Comets do afford us the very beſt Means, tho' they ſeldom happen to determine the Diſtance of the Sun and Earth; which, hitherto, has only been attempted by *Mars*, in his Oppoſition to the Sun; or elſe *Venus* in *Perigæo*; whoſe Parallaxes, tho' triple to that of the Sun, are ſcarce any ways to be perceived by our Inſtruments; whence we are ſtill in great Uncertainty in that Affair. This Uſe of Comets was the ingenious Thought of that excellent Geometrician, Mr. *Nicolas*

las Facio. Now the Comet of 1472, had a Parallax above twenty times greater than the Sun's: And if the Comet of 1618 had come down, about the Middle of *March*, to his deſcending Node; or, if that of 1618 had arrived a little ſooner at its aſcending Node, they would have been yet much nearer the Earth, and conſequently have had more notable Parallaxes. But hitherto none has threatened the Earth with a nearer Applauſe than that of 1680. For, by Calculcation, I find, that *November* 11°. 1h. 6′. *P. M.* that Comet was not above the Semidiameter of the Sun to the Northwards of the Way of the Earth. At which time, had the Earth been there, the Comet would have had a Parallax equal to that of the Moon, as I take it. This is ſpoken to Aſtronomers: But what might be the Conſequences of ſo near an Applauſe, or of a Contact; or laſtly, of a Shock of the Celeſtial Bodies (which is by no means impoſſible to come to paſs) I leave to be diſcuſſed by the Studious of Phyſical Matters.

COMITATU *& Caſtro Commiſſo*, is a Writ whereby the Charge of a Country, together with the Keeping of a Caſtle, is committed to the Sheriff. *L.*

COMITATU *Commiſſo* is a Writ or Commiſſion, whereby the Sheriff is authorized to take upon him the Command of the Country. *L.*

COMITATU *Morbus*, the ſame with *Epilepſia.*

COMMA is one of the Points or Stops uſed in Writing, and is thus mark'd (,) and is the leaſt in Power of them all, implying only a ſmall Reſt, or little Pauſe, without breaking off the Sentence. *L.*

COMMA [in *Muſick*] is the Ninth Part of a Tone, or the Interval whereby a Semi-tone, or a perfect Tone, exceeds the Imperfect. This Term is uſed only in Theorical Muſick, to ſhew the exact Proportion between Concords.

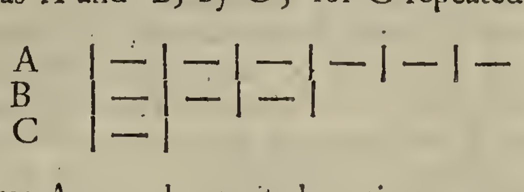
COMMANDING *Ground* [in *Fortification*] is ſuch as overlooks any Poſt or ſtrong Place. Of this they reckon three ſorts; 1. *A Front Commanding Ground*, which is an Height oppoſite to the Face of the Poſt which plays upon its Front. 2. *A Reverſe Commanding Ground*, which is an Eminence that can play upon the Back of any Place or Poſt. 3, *An Enfilade Commanding Ground*, or *Curtin Commanding Ground*, which is an high Place that can, with its Shot, ſcour all the Length of a ſtrait Line.

COMMANDRY, a kind of Benefice, or certain Revenue, belonging to a Military Order, and conferred on ancient Knights who had done Services to the Order; as the *Commandry* of *Malta*.

COMMENDAM is a Benefice, that being void, is commended to the Care of ſome ſufficient Clerk, to be ſupplied till it may conveniently be provided of a Miniſter. He to whom the Church is commended, hath the Fruits and Profits thereof only for a certain Time, and the Nature of the Church is not changed thereby, but is as a Thing depoſited in the Hands of him to whom it is commended, who hath nothing but the Cuſtody thereof, which may be revoked. When a Parſon is made a Biſhop, there is a Ceſſion of his Benefice, by the Promotion; but the King may give him a Power to hold it in *Commendam.*

Before the Reformation, it was common for the Ordinary to grant a Sequeſtration of a Living (eſpecially if in his own Gift, or lapſed to him) for ſix Months Time: And ſuch a Sequeſtration was called *Commenda Semeſtris.* And this was the only *Commendam* that the Canon Law approved of, tho' *Commendams* for a longer Time, and even for Life, were all along uſed. A Biſhop, now, is only capable of holding a Benefice, or other inferior Dignity, by this Title of *Commendam*; which he doth by Licenſe from the Archbiſhop of *Canterbury*, or from the King in *Chancery.* But the Biſhop cannot hold any Living in *Commendam* without the Patron's Conſent, as *Watſon* ſaith, *C.* 18. *P.* 151. In Caſe of a *Commendam*, no Inſtitution is neceſſary; and a Biſhop may be licenſed to hold a Living in his own Gift, by theſe Words: *Authoritate ſua propria capere, & apprehendere abſque Inſtitutione, Inductione, Collatione, &c.*

COMMENSURABLE *Magnitudes* are ſuch as are meaſured by one and the ſame common Meaſure; as A and B, by C; for C repeated 6 times, meaſures A; and repeated 3 times, meaſures B: Therefore A and B are ſaid to be *Commenſurable. Def.* 1, 2, *&c.* 10. *c. e. Euclid.*



COMMENSURABLE *Numbers*, whether Integers or Fractions, are ſuch as have ſome other Number, which will meaſure or divide them without any Remainder: Thus 6 and 8 $_{1}\frac{9}{2}$ and $\frac{3}{4}$ are reſpectively *Commenſurable Numbers.*

COMMENSURABLE [*in Power*] Right Lines are ſaid to be *Commenſurable in Power*, when their Squares are meaſured by one and the ſame Space or Superficies. *Def.* 3. *e.* 10. *Eucl.*

COMMENSURABLE *Surds*, are ſuch Surds, as, being reduced to their leaſt Terms, become true Figurative Quantities of their kind; and are therefore as a Rational Quantity to a Rational.

COMMINUTION is a dividing, breaking, or grinding of a Thing into very ſmall Parts or Particles.

COMMISSARY. In an Army there are two ſorts of Commiſſaries: 1. *The Commiſſary General of the Muſters*, or *Muſter-maſter General*, who takes an Account of the Strength of every Regiment, reviews them, ſees that the Horſe be well mounted, and all Men well armed and accoutred. 2. *The Commiſſary General of Proviſions*, who hath the Charge of furniſhing the Army with all things of that kind.

COMMISSURA *Craſſioris Nervi æmula*, is a Medullary Proceſs in the Brain, connecting together the *Corpora Striata*, or the Tips of the *Crura Medullæ oblongatæ. L.*

COMMISSURES [*Commiſſuræ. L.*] a Word uſed frequently by Mr. *Boyle*, and others, for the ſmall Pores of any Body, or the little Clefts, Cavities, or Interſtices, which are between the Particles of any Body; eſpecially when the Particles are broadiſh and flattiſh, and lie contiguous to one another, like very thin Plates.

COMMON *Axis* [in *Opticks*]. See *Axis.*

COMMON *Diviſor* is that Number which exactly divides any two other Numbers, without leaving any Remainder.

COMMON-PLEAS, is the King's Court now held in *Weſtminſter-Hall.* All Civil Cauſes, both Real and Perſonal, are, or were, in former times, try'd in this Court, according to the ſtrict Law of the Realm. The Chief Judge of that Court is called, *The Lord Chief Juſtice of the Common-Pleas*, aſſiſted with three or four Aſſociates, which are created by Letters Patents from the King, and, as it were, inſtalled, or placed upon the Bench, by the *Lord Chancellor*, and *Lord Chief Juſtice of the Court. Forteſcue*, Cap. 51. The reſt of the Officers belonging to this Court, are the *Cuſtos brevium*, three Prothonotaries, one Chirographer, fourteen Filacers, four Exigenters, Clerk of the Warrants, Clerk of the Juries, or *Jurata Writs*, Clerk of the King's Silver, Clerk of the Treaſury, Clerk of the Eſſoyns, Clerk of the Outlawries; whoſe diſtinct Functions ſee in their proper Places.

COMMON *Ray* [in *Opticks*] is a Right-line drawn from the Point of Concourſe of the two *Optical Axes* through the Middle of the Right-line which paſſes by the Centre of the Pupil of the Eye.

COMMON *Receptacle* [in *Anatomy*] is a certain Veſſel ſo termed, becauſe it receives both the *Chyle* and *Lympha* promiſcuouſly, tho' ſome falſly call it the *Receptacle* of the *Chyle* in particular.

COMMON *Section* of two Planes. See *Section*.

COMMON *Senſory* is the common Perception of all Senſations, or that which receives the Images of ſenſible things, or the Impreſſion made by the Objects upon the Nerves, and according to theſe Impulſes, determines the Appetite, and exerts other Animal Actions.

COMMOTION, an inteſtine Motion or Luctation in the Parts of any thing. *L.*

COMMOTION [in *Medicine*] is frequently uſed for a Blow or Shake of the Brain. Thus a Convulſion is ſaid to be a Commotion of the fine Medullary Fibres of the Brain. A Fall occaſions a Commotion, whence frequently ariſes a Counter-Stroke on the oppoſite Part, which ſometimes cauſes a Contra-Fiſſure; and at other times, a Rupture of the Veſſels, and an Apoſthume, by ſhaking the whole Maſs of the Brain.

COMMUNICATION *of Motion* is the Action of a moving Body, whereby a Body at Reſt is put in Motion, or a Body already in Motion is accelerated.

The Laws of Communication of Motion.

Sir *Iſaac Newton* demonſtrates, That *Action* and *Re-action* are equal and oppoſite; ſo that one Body ſtriking againſt another, and thereby occaſioning a Change in its Motion, does in itſelf undergo the ſame Change in its own Motion, the contrary Way.

Hence a moving Body ſtriking directly againſt another at reſt, the one loſes juſt as much of its Motion as it communicates to the other, and they will proceed with the ſame Velocity as if grown into one Maſs.

Therefore, if the Body in Motion be triple that at Reſt, againſt which it ſtrikes, it will loſe a fourth Part of its Motion; and whereas, before it would have run over (*v. g.*) a Line of 20 Foot, in a given Line, it will now only run over 18; *i. e.* it will loſe a fourth Part of its Velocity.

If a moving Body ſtrike another already in Motion, the firſt will augment the Velocity of the latter, but will loſe leſs of its own Motion than if the latter had been abſolutely at Reſt.

Thus, *v. g.* If a Body in Motion be triple of another at Reſt, and ſtrike againſt it with 32 Degrees of Motion, it will communicate 8 Degrees of its Motion to the other, and retain 24 to itſelf. If the other had already 4 Degrees of Motion, the firſt would only communicate 5 and retain 27, ſince thoſe 5 were ſufficient, in regard of the Inequality of the Bodies, to make them proceed with equal Velocity.

After the ſame manner may be determined the other Laws of Communication in Bodies perfectly hard, and void of all Elaſticity. But all hard Bodies that we know of, have an elaſtick Power, and the Laws are different, and much more intricate in elaſtick Bodies.

If a Body happen to decline out of the Way, when moved by another, ſo as to leave a free Paſſage to the Body by which it was moved; yet that will only proceed with the Velocity which it had after its Communication to the other, not with that it had before. It being a Rule that every thing endeavours to perſevere, not in the State wherein it was formerly, but in that wherein it was at that Juncture: Therefore a Body that has already loſt Part of its Motion by its meeting with another, may ſtill loſe more by a Second and a Third, ſo as at length to become perfectly quiet.

Hence, 1ſt. If two unequal homogeneous Bodies move in a Right-line with the ſame Velocity, the greater muſt perſevere in Motion longer than the ſmaller; for the Motions of Bodies are as their Maſſes, but each communicates of its Motion to the circumjacent Bodies which touch the Surface; the largeſt Body therefore, tho' it has more Surface than the ſmaller, yet having leſs in proportion to its Maſs or Quantity of Matter than the ſmaller, will loſe a leſs Portion of its Motion every Moment than the ſmaller.

As for Example: Suppoſe a Cube A to be two Foot every way, and another B one Foot, the Surfaces here will be as 4 to 1, but their Maſſes as 8 to 1. If therefore thoſe Bodies move with the ſame Velocity, the Cube A will have 8 times as much Motion as the Cube B, (the Quantity of Motion ever being as the Quantity of Matter), that each of them therefore may become quieſcent at the ſame time, the Cube A muſt loſe 8 times as much Motion as the Cube B: But that is impoſſible; becauſe as their Surfaces are to each other as 4 to 1, the Bodies againſt which they ſtrike will be only as 4 to 1. Therefore when the Cube B is become perfectly quieſcent, A will have Half its Motion.

Hence, 2dly. We ſee the Reaſon, why any long Body, as a Dart, thrown long-ways, continues its Motion longer than when thrown tranſverſely, it meeting fewer Bodies in the Way to communicate its Motion to in the one Caſe than in the other.

Hence alſo, 3dly. If a Body be moved almoſt wholly within itſelf, ſo as to communicate little of its Motion to the ambient Bodies, it muſt continue its Motion a long time; thus a ſmooth Braſs Ball of Half a Foot Diameter, ſuppoſed on a ſlender, ſmooth Axis, with a very weak Impulſe, is found to revolve for the Space of 3 or 4 Hours.

Father *Malbranch* ſuppoſes the *Communication of Motion* as ſomething Metaphyſical; *i. e.* as not neceſſarily ariſing from any Phyſical Principles, or any Properties of Bodies, but flowing from the immediate Agency of God; there being, according to him, no more Connection or Dependence between the Motion or Reſt of one Body than that of another, than between the Form, Colour, Magnitude, *&c.* of one Body, and thoſe of another.

Therefore the Motion of one Body is not, upon his Principle, any Phyſical Cauſe of that of another.

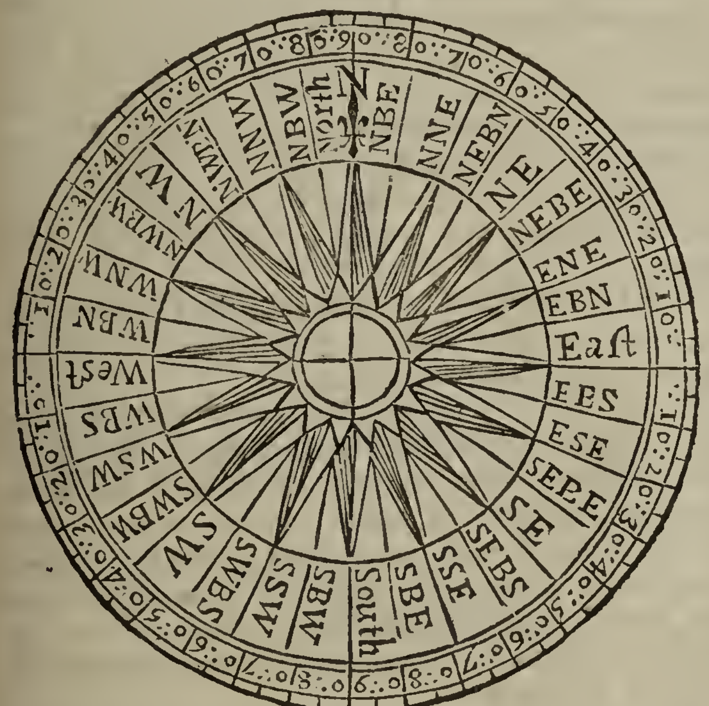
COMMUNICATION. Lines of Communication in the Art of Fortification, are Trenches made to continue and preſerve a ſafe Correſpondence between two Forts or Poſts; or at a Siege, between two Approaches, that they may relieve one another.

COMPARTITION [in *Architecture*] is the uſeful and graceful Diſtribution of the whole Ground-plot of an Edifice, into Rooms of Office, of Reception, or Entertainment. *L.*

COMPARTMENT [in *Architecture*] is a particular Square, or other figured Space (for an Inſcription, *&c.*) mark'd out in ſome ornamental Part of a Building.

COMPASS [in *Navigation*] is a Circle divided into four Quadrants, repreſenting the four Cardinal Winds, or Principal Points, *Eaſt*, *Weſt*, *North*, and *South*; and each Quarter ſubdivided into eight other equal Parts, making, in all, 32 Rhumbs, or Points.

This thus graduated Circle being drawn on a Chard, or Paſtboard, hath a toucht Needle or Wire placed under it, and in its Centre a Braſs little Cell, or a Conical Hollow, by which means it hangs horizontally on an erect Pin, and keeps its Lilly, or North-point, always towards the *North*; by which means the Man at Helm, or Steerſman, knows how to keep the Ship to her Courſe.



This Inſtrument, tho' it be ſubject to Accident, and always to Variation, is yet of vaſt Uſe in Navigation; as alſo in Surveying, Dialling, and many other Parts of the Mathematicks.

The Learned Dr. *Wallis* conjectures, That the *Compaſs* was invented by an *Engliſhman*, becauſe the Word *Compaſs* is uſed in many Parts of *England* for a *Circle*.

The Latin *and* Greek *Names uſed for the* Points *of the* Compaſs, *are as follow:*

NORTH.	*Septentrio.*
N. b. E.	*Hypaquilo*, *Hyperboreas.*
N. N. E.	*Aquilo Gallicus.*
N. E. b. N.	*Meſaquilo Meſoboreas.*
N. E.	*Supernas Borrhapeliotes* (*Vales*).
E. N. E.	*Cæcias*, *Carbas.*
E. b. N.	*Meſocæcias.*
EAST.	*Oriens*, *Subſolanus.*
E. b. S.	*Hypeurus*, *Hypereurus.*
E. S. E.	*Vulturnus.*
S E. b. E.	*Meſeurus.*
S. E.	*Euro auſter*, *vulg. Notapeliotes.*
S. E. b. S.	*Hypophœnix*, *Hypereanotus.*
S. S. E.	*Euronotus*; by *Vegetius*, Δευκόνος.
S. b. E.	*Meſophœnix*, *Meſeuronotus.*
SOUTH.	*Auſter.*
S. b. W.	*Meſolibonotus.*
S. S. W.	*Auſtroafricus.*
S. W. b. S.	*Hypolibonotus*, *Hyperlibonotus.*
S. W.	*Notolibycus*, *Auſtro-Zephyrus.*
S. W. b. W.	*Meſafricus*, *Meſolopus.*
W. S. W.	*Africus*, *Subveſperus.*
W. b. S.	*Hypafricus.*
WEST.	*Favonius*, (*Veget.*) *Subveſpertinus Occidens.*
WEST.	*Occidens.*
W. b. N.	*Meſocorus*, *Meſargeſtes.*
W. N. W.	*Corus*, *Caurus.*
N. W. b. N.	*Hypocorus*, *Hyperargeſtes.*
N. W.	*Corus Eteſiæ*, *Zephyroboreas.*
N. W. b. W.	*Hypocircius*, *Meſothracias.*
N. N. W.	*Circius.*
N. b. W.	*Meſocircius.*

[Metius, *Lib. V. Doctr. Sp.*

COMPASS *Dials*, are ſmall ones fitted in Boxes, for the Pocket, and ſhew the Hour of the Day by the Direction of the Needle; which ſhews how to place them right, by turning the Dial about till the Cock, or Stile, ſtand directly over the Needle, and point up to the Nothward; but theſe can never be very exact, becauſe of the Variation of the Needle itſelf.

COMPASS *of Proportion*, is an Inſtrument to divide Lines and Circles into proportional Parts, at one opening of the Compaſſes, and is very much uſed in reducing or enlarging of Maps or Draughts. The *French* ſometimes call a *Sector* by this Name, the *Compaſs of Proportion.*

COMPERTORIUM, a Judicial Inqueſt in the Civil-Law, made by Delegates, or Commiſſioners, to find out or relate the Truth of a Cauſe.

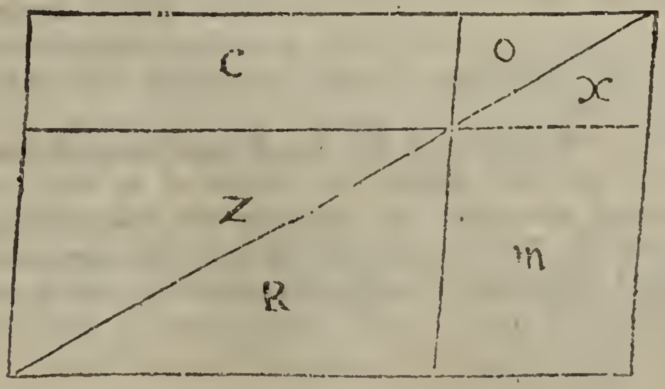
COMPLEMENT *of any Ark of a Circle*, or *of any Angle*, is what it wants of a Quadrant, or 90 Degrees.

COMPLEMENT *of the Courſe* [in *Navigation*] is the Number of Points the Courſe wants of 90 Degrees, or 8 Points, *viz.* of a Quarter of the *Compaſs.*

COMPLEMENT *of the Curtain* [in *Fortification*] is that Part of the Curtain which (being wanting) is the Demigorge.

COMPLEMENT *of the Line of Defence*, is the Remainder of the Line of Defence after you have taken away the Angle of the Flank.

COMPLEMENTS *in a Parallelogram*, are the two leſſer Parallelograms, C and M, which are made by drawing two Right-lines parallel to each Side of the Figure, thro' a given Point in the Diagonal.



Propoſition.

In every Parallelogram the Complements C and M are equal: For $Z + C + O = R + M + X$, as making up on each Side the great Triangle, made = by the Diagonal; of which $Z = R$, and $O = X$ (becauſe the Diagonal makes them ſo) wherefore the remaining Parallelogram $C = M$. *Q. E. D.*

COMPLEX *Terms*, or *Ideas*, [in *Logick*] are ſuch as are compounded of ſimple or ſingle ones; which they call *Incomplex Terms.*

COMPLEX, or *Complicated Diſeaſes.* See *Complication.*

COMPLEXION [in *Phyſicks*] is uſed for the Temperament, Habitude, or natural Diſpoſition of the Body.

COMPLEXION [in *Logicks*] is ſometimes applied to the ſecond Operation of the Mind, *viz.* the Judgment, conſider'd as it affirms or denies any thing. *L.*

COMPLEXUS, a Muſcle of the Head, ſerving to move it backwards. It is alſo called *Trigeminus*, becauſe it hath plainly a three-fold Beginning, and ſeems to be compounded of three Muſcles; one Beginning is from the tranſverſe Proceſſes of the fourth and fifth Vertebræ of the Thorax: The Second, from the firſt and ſecond of thoſe Vertebræ; and the Third, from the Spine of the ſeventh Vertebra of the Neck: After, in their Aſcent, they all unite together, and are inſerted into the *Occiput*, ſometimes by one, and ſometimes by a threefold Tendon. *L.*

COMPLICATION *of Diſeaſes*, is when divers Diſtempers ſeize on the Body at the ſame time, eſpecially if they depend one upon another.

COMPOSITA, or *Compound Medicines*, are Medicines made up of any ſimple Medicines; as, certain Waters, Syrups, Electuaries, Opiates, Trochisks, Ointments, Plaiſters, *&c.*

COMPOSIT *Order* [in *Architecture*] is the laſt of the Five Orders of Columns; and is ſo named, becauſe its Capital is compoſed out of thoſe of the other Columns.

Of the *Tuſcan* and *Dorick* Order, it borrows a Quarter-Round; of the *Corinthian*, a double Row of Leaves; and of the *Ionick*, a Volute. Its Cornice has ſimple Modilions, or Dentils.

The *Compoſit Order* is alſo called the *Roman* and *Italick*, as having been invented by the *Romans*, as the reſt are denominated from the People among whom they had their Riſe.

This Order is, by moſt Authors, rank'd after the *Corinthian*, either becauſe it is the richeſt, or the laſt invented. *Scamozzi* places it between the *Ionick* and *Corinthian*, on account of its Delicacy and Richneſs, which he accounts inferior to the *Corinthian*; and therefore makes it no Scruple to uſe it under the *Corinthian*: And in this Mr. *Le Clerc* follows him.

Vitruvius does not fix the Proportions of this Order; he only marks the general of it, that its Capital is compoſed of ſeveral Parts taken from the *Dorick*, *Ionick*, and *Corinthian.* He does not ſeem to regard it as a particular Order, nor does he vary it at all from the *Corinthian*, except in its Capital.

In Effect, it was *Serlio* who firſt added the *Compoſit* to the Four Orders of *Vitruvius*, forming it from the Remains of the Temple of *Bacchus*, the Arches of *Titus*, *Septimius*, and the Goldſmiths. Till then, this Order was eſteemed a Species of the *Corinthian*, only differing in the Capital.

The Order being thus left undetermined by the Ancients, the Moderns take a Freedom to differ as to its Proportions, *&c.*

Scamozzi, and after him M. *Le Clerc* make its Columns 19 Modules and a Half, which is leſs by Half a Module, than that of the *Corinthian*, as the Order is leſs delicate than the *Corinthian.* But *Serlio*, who firſt form'd it into an Order, by giving it a proper Entablature and Baſe, and after him, Mr. *Perrault*, raiſe it ſtill higher than the *Corinthian.*

COMPOSITION. There is a certain Method of Demonſtration in Mathematicks, called by this Name of

COMPOSITION, which is the Reverſe of the Analytical Method, or of Reſolution: It proceeds upon Principles in themſelves ſelf-evident; on Definitions, Poſtulates, and Axioms, and a previouſly demonſtrated Series of Propoſitions, Step by Step, till it give you a clear Knowledge of the Thing to be demonſtrated. This is what they call the *Synthetical Method*, and is uſed by *Euclid*, in his *Elements.*

COMPOSITION *of Motion*, is the Compoſition of the ſeveral Directions or Declivities of Motion, whether equable or unequable.

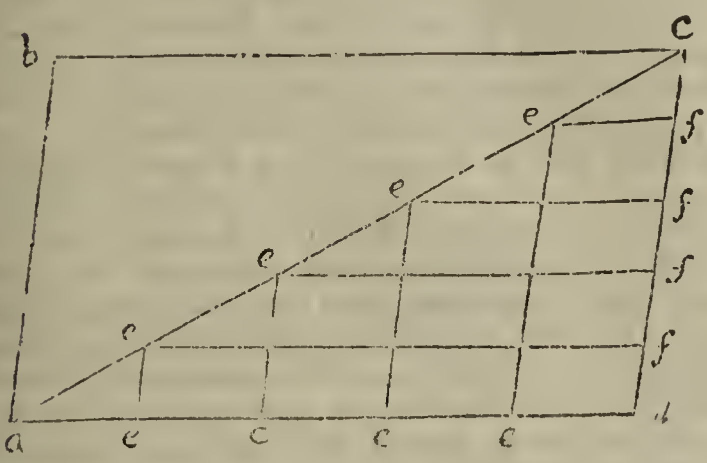
If any Point be ſuppoſed to move or flow (for this Speculation gives an Illuſtration of the Doctrine of Fluxions) according to one and the ſame Direction, whether it move equably or not, whether it be accelerated or retarded in any Proportion whatſoever, it will ſtill keep the ſame Right-line, only the Celerity will be changed, and will be increaſed or diminiſhed, according to the Forces with which it is impelled.

Nay, if the Motion be ſo compounded, as that the Directions be made one quite contrary to the other, as one ſuppoſe directly downward, the other upward, *&c.* yet ſtill the Line of Motion will be the ſame.

But if the Compounding Motions are not according to the ſame Line of Direction, but ſuch as do interſect each other, then the Compound Motion will not be according to the Line of Direction of either of the former, but in a different one from them both; and this either ſtraight or crooked, according as the Directions and Celerities ſhall require.

If two Compounding Motions be each of them equable (or every where equally ſwift) whether the Celerity of thoſe Compound Motions be each to other equal or unequal, yet the Line of the Compound Motion will ſtill be a Straight-line; and this, tho' the Motion be neither at Right-angles one to another, nor equally ſwift, nor (each to itſelf) equable, if they be at leaſt but Similar; that is, if they be both accelerated and retarded alike.

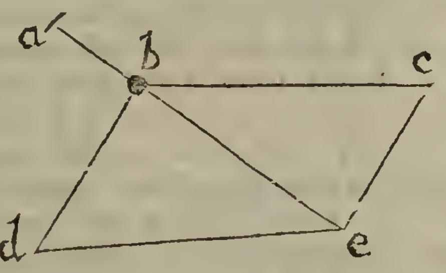
Thus, for inſtance, if the Point *a* be impelled by a double Impulſe of equal Force, both upwards towards *b*, and alſo forwards towards *d*, 'tis plain, that when it is gone forward as far as *e e*, it muſt of Neceſſity be gone upwards as far as *e f*; and if the Motions were both equable, it would always go on in the Diagonal *a c*.



Nay, if the Motions be unequal as to Celerity, ſo as, *v. g.* it moves twice as faſt upward as forward, *&c.* yet ſtill it muſt go on in the Diagonal *a c*, becauſe the Triangles *a e e*, *a e c*, *&c.* and *a c d*, will ſtill be *Similar*, being as the Motions are: But if the Motions be *Diſſimilar*, then the Compound Motion muſt be a *Curve*.

And this Conſideration of the Compoſition of Motions is of great Uſe in Mathematicks. See *Ditton*'s Law of Motion.

If a Body, as *b*, be impelled or drawn by three different Forces, in the three different Directions, *b a*, *b c*, and *b d*, ſo that it yield to none of them, but continue in Æquilibrio; then will thoſe 3 Powers or Forces be to one another as 3 Right-lines drawn parallel to thoſe Lines expreſſing the three different Directions, and terminated by their mutual Concourſes. Let *b e* repreſent the Force by which the Body *b* is impelled from *b* to *a*, then will the ſame Right-line *b e* repreſent alſo the contrary equal Force, by which it is impelled from *b* to *e*. But by what hath been ſaid before in Compoſition of Motion, the Force *b e* is reſolvable into the two Forces acting according to the two Directions, *b d* and *b c*, to which the other impelling from *b* to *e*, is as *b e* to *b d*, and *b c* or *d e*, reſpectively. So likewiſe, two Forces acting without the Directions *b d*, *b c*, and being equipollent to the Force acting without the Direction *b e*, from *b* to *e*, will be to the Force acting according to the Direction *b e* from *b* to *e*, as *b d*, *b c*, to *b d*; and therefore the Forces acting in the Directions *b d*, *b c*, and equipollent to the Force acting in the Direction, *b e*, are to the Force acting in the Direction, as *b d*, *b c*, or *d e* to *b e*: That is, if a Body be urged by three different equipollent Powers, in the Directions *b a*, *b d*, and *b c*, theſe three Forces ſhall be to one another, as *b e*, *b d*, and *d e*, reſpectively. *Q. E. D.* And this ſingle Propoſition is the Foundation of all the Mechanicks, as hath been often ſhewn by Geometers.



COMPOSITION *of Proportion*, the comparing the Sum of the Antecedent and Conſequent with the Conſequent in two equal Ratio's, as ſuppoſe 4. 8 : : 3. 6. they ſay, by Compoſition of Proportion, 12. 8 : : as 9. to 6. But,

There is, as Dr. *Wallis* well diſtinguiſhes it in his *Algebra* (*Engl. Ed.* p. 85.) a great Difference between Compoſition of Proportion by Addition, and by Multiplication; the Inſtance above is of Compoſition by Addition, but if it had been 4 × 8, it would have been Compoſition by Multiplication. In one Word, Compoſition of Proportion by Addition, is by Addition of the Indices of the Ratio's; but by Multiplication, it is when the Ratio's are multiplied into one another. See more of this Matter under the Word *Proportion*.

COMPOSITION *of Quantities*, with reſpect to the *Doctrine of Combinations*, is the joining in any Number of given Quantities, Letters, or Figures, one Row with another Row of the ſame, or with two, or three, or more, other Rows. See *Combination*.

COMPOSITION [in *Painting*] comprehends two Parts, *Invention* and *Diſpoſition*; one of which finds out (by the means of Hiſtory) proper Objects for a Picture; and the other places them aright: The juſt Mixture of which two Things, according to a true Oeconomy, is properly *Compoſition*.

COMPOSSIBLE is an old barbarous Word, uſed to ſignify ſuch things as are capable of exiſting together; whereas ſuch things as cannot exiſt together are called *Impoſſible things*.

COMPOUND *Intereſt*, are thoſe which ſome Number may meaſure, beſides Unity; as 15, which is meaſured by Five and Three.

COMPOUND *Quantities* [in *Algebra*] are ſuch as are connected together by the Signs + and —, and are expreſſed by more Letters than one, or elſe by the ſame Letters unequally repeated; thus, $a + b - c$, and $b b - b$, are Compound Quantities.

COMPOUNDED, *Compoſit*, or *Aggregated Flower of a Plant*, is, by the *Botaniſts*, accounted ſuch an one as conſiſts of many little Flowers, concurring together to make up one whole one, each of which hath its *Style* and *Stamina*, and adhering Seed, and are all contain'd within one and the ſame *Calyx*, or *Perianthium*. This *Compoſit Flower* diſtinguiſhes a large Genus of Plants, which our accurate Botaniſt, Mr. *Ray*, divides as follows:

Herbs of Compounded or Aggregated Flowers, are:

1. Such as have a plain Leav'd Flower naturally, and for the moſt part full, and having their whole Body milky, (*i. e.* on cutting or cropping, yielding a milky Juice) and theſe have their Seeds

(1) *Pappous*, or *Winged*; *i. e.* having a little Lanugo adhering to each Seed, by which the Wind can carry it eaſily from Place to Place; ſuch as the *Lactuca*, *Tragopogon*, *Scorzonera*, *Dens Leonis*, *Hieracium*, and the *Piloſella*.

(2) Such as have ſolid Seed, without any Pappous or Down upon them; as the *Eringeum*, *Luteum*, *Cichorium*, *Lampſana*.

2. Such as have a *Diſcous Flower*, that is, one compoſed of many ſhort, thick, compreſſed, ſmall Floſculi (which ſome by miſtake call Stamina) ſet together ſo as to make one flat or hollowiſh Superficies: And theſe alſo either are ſuch as have their Seeds,

(1) *Pappous* ; as the *Tuſſilago*, *Petaſites*, *Carlina*, *Helenium*, *Doronicum*, *Conyza*, *Aſter*, *Virga Aurea*, *Jacobæa*, *Stæchas Citrini*, *Jacea*, *Senecio*, *Eupatorium Avicennæ*, *Cacalia Vulgaris*, *Gnaphalium Maritimum*, and *Monſpelienſium*.

(2) Such whoſe Seeds are Solid and not Pappous, as the *Corymbiferous Herbs* ; which ſee under that Word.

COMPREHENSION [in *Metaphyſicks*] is an Act of the Mind, whereby it apprehends or knows any Object preſented to it on all Sides whereon it is capable of being apprehended or known.

COMPREHENSION [with *Rhetoricians*] is a Trope or Figure whereby the Name of a Whole is put for a Part, or that of a Part for a Whole; or a definite Number of any thing for an indefinite.

COMPRESS [with *Surgeons*] a Bolſter of Linen Cloth folded in ſeveral Doubles, and laid under the Bandages, either to prevent a Wound from bleeding or ſwelling, or to retain the Medicines applied to them.

COMPRESSION, the Act of preſſing or ſqueezeing ſome Matter, ſo as to ſet its Parts nearer to each other, and make it poſſeſs leſs Space. It is different from Condenſation, in that Compreſſion is perform'd by ſome external Violence; but Condenſation by the Action of Cold.

Thus the Moderns ſay, that Pumps do really act by Compreſſion; whereas the Ancients imagined they acted by Suction. The Embolus, or Sucker, going and returning in a narrow Tube, compreſſes the Air incloſed in it; ſo as to enable it to raiſe the Valve by the Force of the Elaſticity, and make its Eſcape; upon which the Balance being deſtroyed, the Preſſure of the Atmoſphere on the ſtagnant Surface, drives up the Water into the Tube thus evacuated of its Air.

For Water is incapable of being compreſs'd, and no Art or Violence is able to bring its Parts cloſer, or make it take up leſs Space, after the Air has been once purg'd out of it: For it has been found, by an Experiment made by the Academy *de el Cimento*, that Water being violently ſqueez'd, made its Way thro' the infinitely ſmall Pores of a Ball of Gold, rather than undergo a Compreſſion.

The Compreſſion of the Air by its own Weight, is ſurprizingly great: For it appears by Calculation, that the common Air we breathe near the Surface of the Earth, is compreſſed by a Weight of the ſuperincumbent Atmoſphere, into $\frac{1}{13760}$ Part of the Space it would take if it were at Liberty.

But the Air may be ſtill further compreſſed by Art: And it appears by Mr. *Boyle*'s Experiments, that the Space which the Air takes up when at its utmoſt Dilatation, is to that which it takes up when moſt compreſs'd, as 550000 to 1.

Sir *Iſaac Newton* obſerves, that this immenſe Compreſſion and Dilatation cannot be accounted for by ſuppoſing the Particles of the Air elaſtick or branch'd, or in form of ſlender Twigs interwoven into Circles, nor any other way, but by a repelling Force, with which they are endued; by Virtue whereof, they mutually fly each other when at Liberty.

He adds, That this repelling Power is ſtronger and more ſenſible in Air than in other Bodies, in regard the Air is generated out of very fix'd Bodies, but not without the greateſt Difficulty, which, when contiguous, cohere the moſt ſtrongly.

That there is ſuch a repelling Power in the Air, appears from this, that Flies walk in the Water without wetting their Feet; that the Object Glaſſes of Teleſcopes laid on each other do not touch; that dry Duſt is not brought to touch or cohere without Difficulty, *v. g.* unleſs either liquified by Fire, or wet with Water; and that two poliſh'd Pieces of Marble, that as often as they touch, cohere, are yet very hardly preſs'd, ſo cloſely, and joined ſo aptly, as to cohere.

COMPULSION, is when, in an Agent capable of Volition, the Beginning or Continuation of any Action is contrary to the Preference of his Mind.

COMPUTO, is a Writ ſo called of the Effect, becauſe it compelleth a Bailiff, Receiver, or Chamberlain to yield up his Accounts: It lieth alſo for Executors of Executors; and againſt the Guardian in Soccage, for Waſte made in the Minority of the Heir.

CONARION, or the *Glandula Pinealis*, is a Part of the Brain hanging in a ſmall Cavity, called the *Anus*, in the Hinder-part of the third Ventricle of the Brain, and leading into the fourth; it is ſo called from being of the Shape of a Pine Cone. *Des Cartes* ſuppoſed this Glandule to be the Seat of the Rational Soul; but its Subſtance being the ſame with the reſt of the Brain, 'tis probable it ſerves for the ſame Uſe. *L.*

CONATUS *Recedendi ab Axe motus*, is the Endeavour which any Body moved circularly hath to recede or fly off from the Centre or Axis of its Motion. *L.*

CONATUS *Centrifugus*. This is ſometimes called the *Conatus Excuſſorius*, and is always expreſſed by the verſed Sine of the Angle of Circulation, and theſe *Conatus Centrifugi* of Bodies revolving in equal Circles, with an equable Motion, are in a duplicate Ratio, or as the Squares of their Velocities. But if the Bodies revolve in unequal Circles, their *Conatus Centrifugi* will be in a Ratio compounded of the Ratio of the Squares of the Velocities directly, and the ſimple Ratio of the Radii of thoſe Circles inverſly. If the Body deſcribe equal Areas in equal Times (as is the Caſe of the Planets which revolve in Ellipſes round the Sun) then the *Conatus Centrifugi* will be reciprocally as the Cubes of the Radii. *L.*

CONATUS *Excuſſorius*. See *Conatus Centrifugus*.

To CONCAMERATE [in *Architecture*] is to make an arched Roof, as in Vaults, *&c.* to arch over.

CONCATENATION *of Cauſes*, is a Term ſometimes uſed to expreſs, that an Effect is the Reſult of a long Chain of Cauſes depending upon, or linked one to another. *L.*

CONCAVE and *Concavity*, ſignifies the Hollowneſs of any thing. See *Convexity*.

CONCAVE *Glaſſes*, are ſuch as are ground hollow, and are uſually of a ſpherical Figure, tho' they may be of any other; as parabolical, *&c.*

All Objects ſeen thro' *Concave Glaſſes* appear erect and diminiſhed or leſſened.

What the *Virtual Focus* of a *Concave Glaſs* is, ſee under that Term.

The confuſed Appearance of a Point thro' any *Concave Glaſs* proceeds from the too great Divergence of thoſe Rays which fall on the Eye; wherefore, becauſe the more remote the Eye is from the Glaſs, the leſs will the Rays diverge; therefore the farther the Eye is from a *Concave Glaſs*, the more diſtinct will be the Appearance of any Object thro' it, tho' the more faint.

The *Apparent Place* of Objects ſeen thro' Concaves, is always brought nearer to the Eye; which is the Reaſon why they help ſhort-ſighted Perſons, or ſuch as can ſee only nigh Objects diſtinctly.

For a Rule to fit a *Concave Glaſs* to the Eye of ſuch a Perſon, let him obſerve nicely the Diſtance at which he can read Letters, or ſee Objects diſtinctly; which ſuppoſe to be at 12 Foot, then will a *Concave Glaſs*, whoſe *Virtual Focus* is a Foot diſtant from it, make that Perſon ſee diſtant Objects diſtinctly.

The farther the Eye is removed from any *Concave Glaſs*, the leſs the Object appears, and a leſſer Area of it is ſeen; and when the Glaſs is exactly in the Middle, between the Eye and the Object, the Object will appear the moſt diminiſhed, that that Diſtance between the Eye and Object will allow of.

CONCENTRATION, the returning or withdrawing of a thing inwards, or driving towards the Centre or Middle. *L.*

According to Dr. *Grew*, *Concentration* is the higheſt Degree of Mixture, and is when two or more Atoms, or Particles of the Mixture, do touch by Reception and Intruſion of one into the other: And this he takes to be the Caſe of all fix'd Bodies, which are without Taſte or Smell, whoſe Conſtitution is ſo firm, that till the Particles are, as it were, unprim'd from each other, they cannot affect either of thoſe Senſes.

CONCENTRICK *Figures*, are ſuch as have the ſame common Centre.

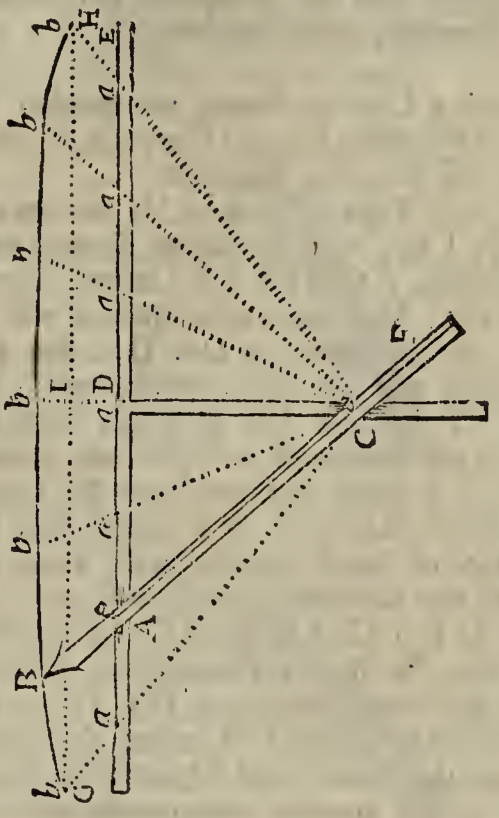
CONCEPTIO, a Grammatical Figure. See *Syllepſis*. *L.*

CONCEPTION, is the ſimple Apprehenſion, Perception, or Idea, that we have of any thing, without proceeding to affirm or deny any thing about it.

CONCERT, CONCERTO [in *Muſick*] a Conſort, a Number or Company of Muſicians playing or ſinging the ſame Song or Piece of Muſick together.

CONCHA, is the winding of the Cavity of the inner Part of the Ear. *L.*

CONCHILIS, CONCHOID [in *Geometry*] is the Name of a Curve, called (by its Inventor, *Nicomedes*) the *Firſt Conchoid*, and is thus produced.



If a Right-line, as B A F, be ſo conceived to be moved within the Right-angle A D C, C D E, that the Point C keep always in the Perpendicular C D, and the Point A run always in the Line A D E; by that complicated Motion 'tis eaſy to ſee (by the Figure) that a Curve may be Organically deſcribed by the Motion of B, the Point of the Sliding Ruler B A F. And this Curve *Nicomedes* calls *Conchoides Prima*, which hath this Property, that tho' the Right-lines C B, C *b*, *&c.* drawn from the Centre C to the Ambit of the Curve, are not as in the Circle, equal to one another; yet that Part of them which is between the Curve and the Directrix A E, as A B A *b*, *&c.* is always of one and the ſame Length; as is plain from the Geneſis of the *Conchoid.*

PROP. I.

This Conchoid B b b *muſt, on both Sides the Perpendicular* C D b, *always approach nearer to the Horizontal Line, or Directrix,* A E, *and yet can never coincide with it.*

For the Lines *a b a b*, being all of the ſame Length, and but one only (*viz.* *b* D) perpendicular to A E, 'tis plain, as they grow more remote either way from the Perpendicular, they muſt be ſtill more and more inclined to the Directrix A E, and make Angles more and more acute with it; wherefore the Point *b* muſt continually come nearer and nearer to the Line A E.

Alſo, becauſe the Lines B A F and *b a f* are ſtill Right-lines, as is alſo the Line A E; and ſince the Point A can never go out of the A E, 'tis impoſſible that the Point *b* in the Curve can ever come to be coincident with the Point *a* (for 'twill always be diſtant from it at Length of the Right-line A B) and conſequently the Curve can never come to touch the Line A E. *Q. E. D.*

Prop. II.

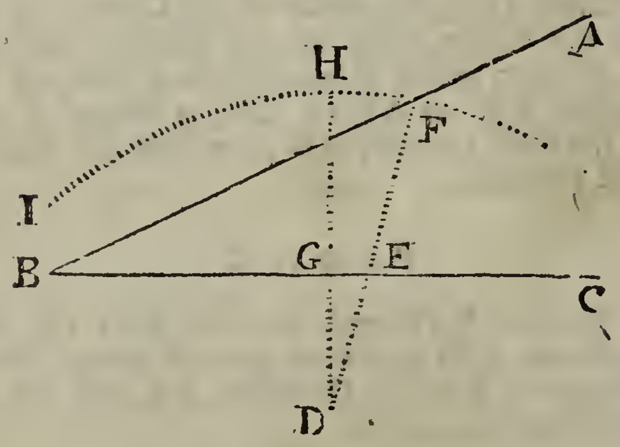
Yet can there no Right-line be poſſibly drawn between the Curve and the Directrix, but what will cut the Conchoid, when produced.

If ſuch a Line be drawn, not parallel to A E, it muſt of Neceſſity cut the Curve at the End, where it goes off from the Directrix.

But let a Right-line, as G H, be drawn parallel to A E; I ſay, let it be never ſo near to A E, yet if produced, it ſhall cut the Curve: For make, as D I. I C : : D *b.* to a 4th, then it will be Alternately, and Inverſely, as D *b.* D : : that 4th to I C, wherefore this 4th Proportional muſt be longer than I C, becauſe D *b* is longer than D I, make this 4th the Radius of a Circle, and from C ſtrike an Ark; it muſt cut the Line G H ſomewhere, becauſe the Radius of it is longer than I C. Let the Place of Interſection be in G, I ſay, that Point G is in the *Conchoid*; for draw C *a* G, and it will be as D I. I C : : G *a.* G C, by ſimilar △, but G C was the fourth Proportional before found; and it was made before, as D I. I C : : D *b.* G C. Wherefore G A and D *b* having the ſame Proportion to the ſame third Quantity G C, muſt be equal to one another; and conſequently the Point G is in the Curve (as is plain from its Geneſis above delivered); and therefore the Right-line G H will cut the Curve. *Q. E. D.*

Corollary.

Hence may a Right-line D E F, from any Point, as D, without the given Angle A B C, be ſo drawn, that the Part of it E F contained within the Legs of the Angle ſhall be equal to Z a Line given.



From the Point D let fall a Perpendicular to one Leg of the Angle, as B C, and making G H equal to Z, thro' the Point H deſcribe the *Conchoid* I H K; which muſt be cut by the other Leg of the Angle (by this *Prop.*) as ſuppoſe in F, draw D F, and E F is the Line required.

How by the Help of this *Conchoid*, and the preceding *Corollary*, to find two mean Proportionals between any two given Lines. See *Mean Proportionals.*

CONCINNOUS *Intervals* [in *Muſick*] are ſuch as are fit for Muſick, next to, and in Combination with Concords, they being neither very agreeable nor diſagreeable in themſelves; but having a good Effect, as by their Oppoſition they heighten the more eſſential Principles of Pleaſure; or as by their Mixture and Combination with them, they produce a Variety neceſſary to pleaſe better.

CONCINNOUS *Syſtem* [in *Muſick*]. A Syſtem is ſaid to be concinnous, or divided concinnouſly, when the Parts of it, conſidered as ſimple Intervals, are concinnous; and are, beſides, placed in ſuch an Order between the Extremes, as that the Succeſſion of Sounds, from one Extreme to the other, may have an agreeable Effect.

CONCLAVE [in *Architecture*] a Cloſet or Inner Chamber.

CONCOCTION, or *Digeſtion*, is the Fermentation of the ſmalleſt Particles which our Nouriſhment conſiſts of, that they may be made fit and proper for the Nouriſhment and Increaſe of a living Body. The firſt Concoction is made in the Stomach, by a kind of Ferment, (as moſt ſuppoſe) which partly remains there, from the Relicks of the former Meats, and partly flows thither from the Cœliack Arteries. The ſecond is made in the Guts, by the Gall and Pancreatick Juice. The third is in the Glandules of the Meſentery, from the Lympha or Water which mixes itſelf with the Chyle. The fourth is in the Lungs, from the mixing the Air in ſome meaſure with the Blood there. The fifth is in the Veſſels and Bowels, as in the Spleen, Liver, Teſticles, *&c.*

CONCORDS [in *Muſick*] are certain Intervals between Sound, which delight the Ear, when heard at the ſame time. Theſe *Concords* are the Third, Fifth, Sixth, and Eighth, together with their Octaves, as the Tenth, Thirteenth, Fifteenth, *&c.* They are alſo of two ſorts, *Perfect* and *Imperfect*: *Perfect Concords* are the Fifth and Eighth, with all their Octaves: *Imperfect Concords* are the Third and Sixth, with their Octaves. The *Imperfect* have yet another Diſtinction, *viz.* the greater and leſſer Third, as alſo the greater and leſſer Sixth. Some reckon the *Uniſon* among the *Concords*, but others will not admit it into the Number of the Intervals.

CONCRETE, is the Subject in which any Qualities inheres. See *Abſtract.*

CONCRETE [in *Natural Philoſophy* and *Chymiſtry*] ſignifies a Body made up of different Principles, and therefore is of much the ſame Signification as the Word *Mix'd.* Thus *Soap* is a *Factitious Concrete*, or a Body mix'd together by Art; and *Antimony* is a *Natural Concrete*, or a mixed Body compounded in the Bowels of the Earth.

CONCRETE is alſo uſed in *Logick*, in Contradiſtinction to the Word *Abſtract*, *v. gr.* when we conſider any Quality, as Whiteneſs, inhering in any Subject, as ſuppoſe in *Snow*, if we ſay *the Snow is White*, then we ſpeak of Whiteneſs in the *Concrete*; but if we conſider Whiteneſs, by itſelf, as a Quality that may be in Paper, in Ivory, and in other things, as well as in Snow, we are then ſaid to conſider, or to take it in the *Abſtract.*

CONCRETE *Numbers*, are thoſe which are applied to expreſs or denote any particular Subject, as, Two Men, Three Pounds, Two-thirds of a Shilling, *&c.* Whereas if nothing be connected with the Number, 'tis taken abſtractly, or univerſally. Thus Three ſignifies only any Aggregate of three Unites, let thoſe Unites be Men, Pounds, or what you pleaſe.

CONCRETION, is the uniting together of ſeveral ſmall Particles of a natural Body into ſenſible Maſſes, or *Concretes*, whereby it becomes ſo and ſo figured and determined, and is indued with ſuch and ſuch Properties.

CONCURRING, or *Congruent Figures* [in *Geometry*] are ſuch as, being laid upon one another, will exactly meet and cover one another ; and therefore 'tis a received Axiom, in reference to Plane or Superficial Figures, *Quod quæ ſibi mutuo congruunt ſunt æqualia* ; *i. e.* Thoſe Figures which will exactly cover one another are equal.

CONDENSANTIA. See *Incruſtantia.*

CONDENSATION *of any Natural Body*, is, when it takes up leſs Space, or is confined within leſs Dimenſions than it was before ; or, the Act whereby a Body is rendred more denſe, compact, and heavy.

CONDENSER, a *Pneumatick Engine*, whereby an unuſual Quantity of Air may be crowded into a given Space.

They can throw 3, 4, 5, or 10 Atmoſpheres into the *Condenſer* ; *i. e.* twice, thrice, four, *&c.* times as much Air as there is at the ſame time in the ſame Space, without the Engine.

CONDITIONAL *Propoſitions*, are ſuch as have two Parts bound together by the conditional Particle (*if*) of which the firſt, where the Condition lies, is called the *Antecedent*, and the other the *Conſequent* : Thus, *If the Soul be Spiritual, it is Immortal*, is a conditional Propoſition, *wherein, if the Soul be Spiritual*, is the Antecedent ? *It is Immortal*, is the Conſequent.

CONDUCTOR, a Surgeon's Inſtrument, to be put up into the Bladder, to guide or conduct the Knife, in the Operation of cutting for the Stone.

CONDUCTS [in *Architecture*] Sewers or Gutters to convey away the Scullage of a Houſe, ſo called of *Conduits. L.*

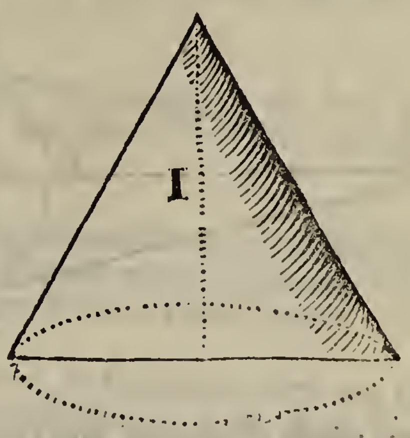
Sir *Henry Wotton* ſays, That in theſe Art ſhould imitate Nature, in ſeparating thoſe ignoble Conveyances from the Sight ; and (where there wants a running Water) ſhould place them in the moſt remote and loweſt Part of the Foundation, with ſecret Vents paſſing up thro' the Walls (like a Tunnel) to the wide Air ; which all *Italian* Artiſts commend, for the Diſcharge of noiſom Vapours.

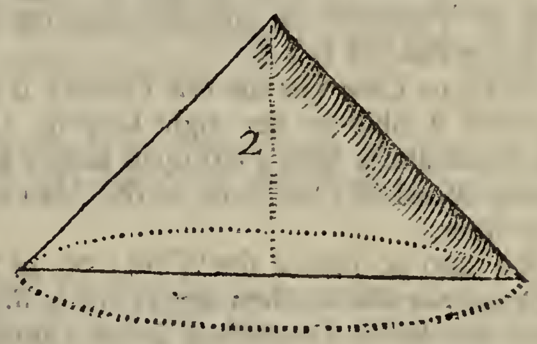
CONDYLI, are the Joints and Knuckles of the Fingers.

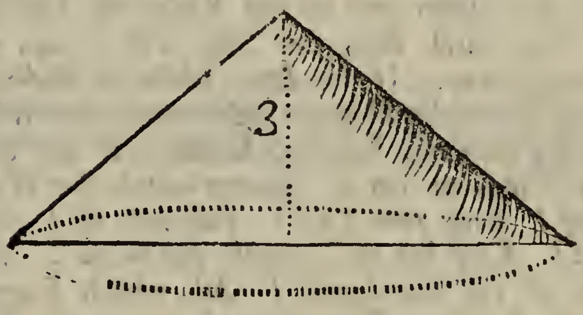
CONDYLOMA, is the knitting or jointing of the Joints of an Animal Body : Alſo a certain Tumour in the little Skin of the Fundament ; an hard and callous Swelling, growing from black Humours that flow thicker, and rather troubleſome than painful. Sometimes alſo it is accompanied with an Inflammation. *Blanchard.*

CONDYLUS [Κόνδυλος, *Gr.*] a Name given, by *Anatomiſts*, to a little round Eminence, or Protuberance, at the Extremity of a Bone.

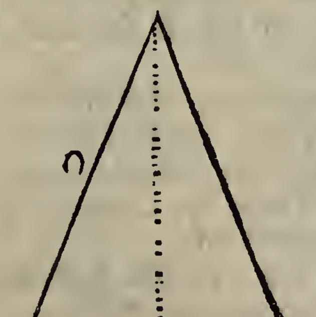
CONE is a ſolid Figure, whoſe Baſe is a Circle, and is produced by the Revolution of the Plane of a Right-angled Triangle round the perpendicular Leg ; which Leg (or Axis) if it be equal to the Baſe, the Solid produced is an *Acute-angled Cone*, (as 2.) if it be leſs, it is an *Acute-angled Cone* ; but when greater, an *Obtuſe-angled Cone.*

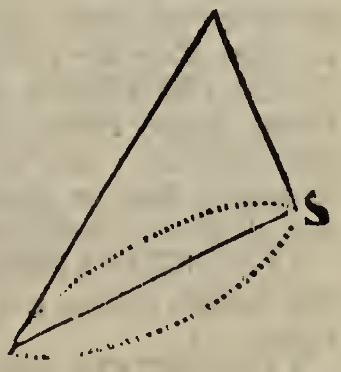






A *Cone* is ſaid alſo to be *Right*, as to the Poſition of its Axis, in reſpect to the Horizon ; *i. e.* when its Axis is not ſo, 'tis called an *Oblique Cone.* A *Cone* is called *Scalenous*, when one Side of it is longer than the other, as S.





The ſolid Content of a *Cone* is found by multiplying the Area of its Baſe by $\frac{1}{3}$ of its perpendicular Height.

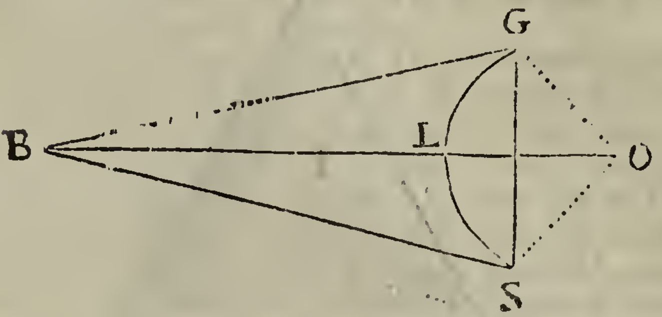
For a *Cone* is but a *Pyramid* of infinite Sides ; and a *Pyramid* is equal to $\frac{1}{3}$ of its circumſcribing *Priſm*, and a *Priſm* is but a *Cylinder*, having an infinite Number of Sides ; therefore a *Cone* is equal to $\frac{1}{3}$ of a Cylinder circumſcribing it. 7. *e.* 12. *Eucl.*

See alſo the Demonſtration under *Proportion of Solids.*

How to find the External Surface of a *Cone*, ſee under the Word *Pyramid.*

If a *Cylinder*, *Sphere*, and *Cone*, have the ſame Baſe and Altitude, the *Cone* is the Difference of the *Cylinder* above the *Sphere*; and *Cylinder*, *Sphere*, and *Cone*, are as 3, 2, and 1. See *Cylinder*.

CONE *of Rays* [in *Opticks*] are all thoſe Rays which fall from any Point, as ſuppoſe B, in any Object, on whoſe Surface of any Glaſs, as G L S, having its Vertex in B, and the Glaſs for its Baſe, ſuch is the *Cone* G L S B.



CONE, or *Conn* [in the *Sea Phraſe*] is to guide or conduct a Ship in her right Courſe. He that *conns*, ſtands aloft, with a Compaſs before him, and gives the Word of Direction to the Man at Helm, how to ſteer.

If the Ship go before the Wind; or, as they call it, *betwixt the Sheets*, then the Word is, *Starboard*, or, *Port the Helm*, (according as the *Conner* would have the Helm put to the Right or Left-ſide of the Ship) and then the Ship will always go the contrary way. If he ſays, *Helm a Mid-Ship*, he would have the Ship go right before the Wind, or directly between her two Sheets. If the Ship ſail by a Wind, or on a Quarter-wind, the Word is, *Aloof! Keep your Luff! Fall not off! Veer no more! Keep her to! Touch the Wind! Have a Care of the Lee-Latch!* All which Expreſſions are of the ſame Import, and only imply, that the Steerſman ſhould keep the Ship near the Wind. On the contrary, if he would have her ſail more large, or more before the Wind, the Word is, *Eaſe the Helm! No near! Bear up!* But if he cries *Steady!* It means no more than *Keep her from going in and out*, or *making Yaws* (as they call it) howſoever ſhe ſails, whether large by a Wind; and when he would have her go juſt as ſhe doth, he cries, *Keep her thus! Thus! &c.*

CONFECTIONS, a Compoſition of Powders, Gums, Sugar, Honey, Syrups, *&c.* made up into one Subſtance; and it is two-fold, either dry, as Lozenges, *&c.* or moiſt, as Preſerves, Conſerves, and all ſorts of Antidotes. *Blanchard.*

CONFIGURATION, is the external Surface that bounds Bodies, and gives them their particular Figure. *L.*

CONFISCATE [in *Law*] ſignifies to be forfeited to the Publick Fiſque or King's Treaſury: For among the *Romans*, the Emperor's Treaſure was kept in Hampers or Baſkets, which, in *Latin*, is *Fiſcus*. Now, if a Man be indicted for feloniouſly ſtealing the Goods of another, tho' in Truth they are the proper Goods of the Perſon indicted, yet if, when the Goods are brought in Court againſt him, as the Manner is, he ſhall then diſclaim them, he doth, by this Diſclaimer, loſe the Goods, altho' he be afterwards acquitted of the Felony, and they ſhall be confiſcated to the King; but it is otherwiſe if he does not diſclaim them. The ſame Law is, where Goods are found in the Felon's Poſſeſſion, which he diſavows, and afterwards is attainted of other Goods, and not of them, there the Goods which he diſavows are confiſcated to the King; but had he been attainted of the ſame Goods, they ſhould have been ſaid to be Forfeited, and not Confiſcated, notwithſtanding the Diſavowment. So if an Appeal of Robbery be brought, and the Plaintiff leaves out ſome of his Goods, he ſhall not be received to enlarge his Appeal: And foraſmuch as there is none to have the Goods ſo left out, the King ſhall have them, as confiſcate, according to the old Rule, *Quod non capit Chriſtus, capit Fiſcus.*

CONFUSED *Viſion.* See *Viſion.*

CONGE, a Term in Architecture. See *Apophyge.*

To CONGEAL [in *Chymiſtry*] is to let ſome Matter that is melted, fix or grow into a Conſiſtency; as, when a Metal is left to cool, which hath been melted in a Crucible; or, when Wax, Fat, Butter, or the like, are taken from the Fire, and ſet to cool, they ſay, *'tis let congeal.*

CONGLOBATE, a Word uſed for ſuch of the Glands in an Animal Body as are ſmooth in their Surface, and ſeem to be made up of one continued Subſtance: They ſerve to ſeparate the Lympha from the Arterious Blood, and to return it by the Lympheducts, either into the Chyliferous or Sanguiferous Veſſels, tho' ſome think the Glands of the Meſentery, and Breaſts of Lacteſcent Women, ſerve to ſeparate true Chyle.

CONGLOMERATE *Glands* are ſuch, in an Animal Body, as are uneven in the Surface, and are made up, as it were, of many leſſer Glands. Their Uſe in the Body, is, to ſeparate ſeveral ſorts of Juices from the Blood, and alſo to elaborate and alter them, and, by proper Ducts, to convey them to their appropriate Receptacles and Cavities. Thus the Parotides and Maxillary Glands ſeparate, and bring the Saliva into the Mouth, by their proper Ducts.

CONGENERES *Muſculi*, are ſuch Muſcles in an Animal Body, as ſerve together to produce the ſame Motion; and they are ſo called, becauſe they aſſiſt one another in their Action. *L.*

CONGREGATION, according to Dr. *Grew*, is the leaſt Degree of Mixture, in which the Parts of the Mixture are inconſiſtent, and do touch each other but in a Point: And he ſaith, he hath many Arguments to induce him to believe, that the Atoms or Particles of all Fluids, as ſuch, do touch one another only after that manner.

CONGRUITY [*Congruitas, L.*] by the Naturaliſts, is eſteemed a Relative Property to a Fluid Body, whereby any Part of it is readily united with any other Part, either of itſelf, or of any other Similar Fluid, or Solid Body. And *Incongruity* is a Property by which it is hindred from uniting with any Solid or Fluid Body diſſimilar to it.

That there is ſuch a Property as *Congruity* in the Particles of ſeveral Fluids, is plain from theſe and ſuch like Inſtances: Quick-ſilver will ſtick to Gold, Silver, Tin, Lead, *&c.* and unite with them; but will roll off from Wood, Stone, Glaſs, *&c.* and Water, that will wet Salt and diſſolve it, will ſlip off from Tallow, *&c.* without adhereing to it, as it will from a duſty Surface, and from the Feathers of Water-Fowls. Two Drops of Water, or of Mercury, will, on Contact, immediately join and coaleſce: But Oil of Tartar poured on Quick-ſilver, and Spirit of Wine on that Oil, and Oil of Turpentine on that, and Air over all, though theſe are ſtopp'd in a Bottle, and ſhaked never ſo long, they will by no means continue mingled, but will ſeparate and keep diſtinct. Whether the Cauſe of this *Incongruity* be not, that the Particles of the Fluids cannot be brought ſo near to one another, as to come within the Sphere of one another's Attraction ; and why they cannot be brought to do ſo by ſhaking, are Enquiries worth purſuing. The ingenious Dr. *Hook* calls *Congruity* both a *Tenacious* and *Attractive Power*, in which he is certainly right ; but, perhaps, what he takes to be the Effects of *Congruity*, is the Cauſe of it.

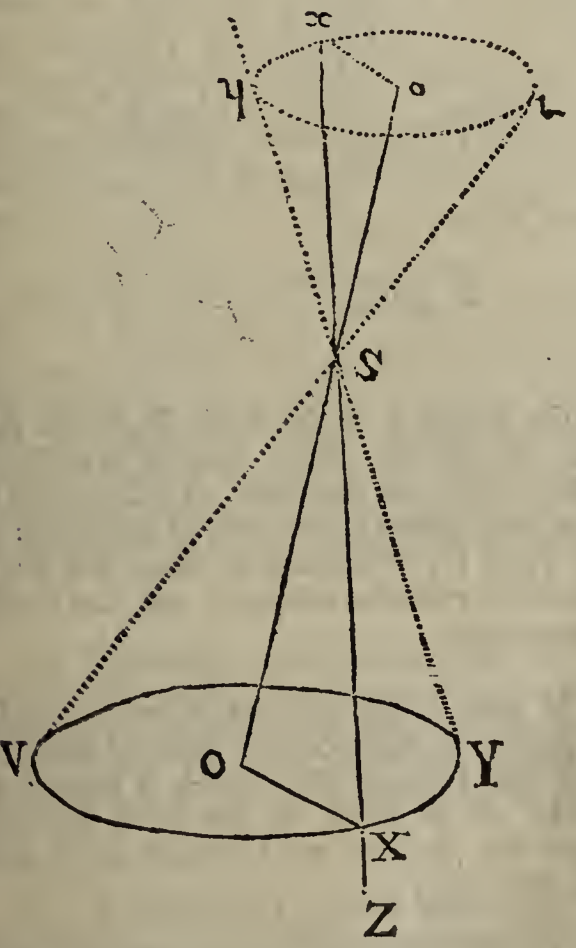
CONGRUITY *of Geometrical Figures*. See *Concurring*.

CONICK-SECTIONS. I thought fit to give the Reader here a Tranſlation of *L'Hoſpital's* Sixth Book of *Conicks* ; wherein he will ſee how the Sections, and their primary Properties, are deduced from the Cone itſelf, without the tedious Number of Lemma's, which ſome have premiſed about a Line cut harmonically ; whoſe Demonſtrations alone, are more than all theſe Propoſitions, and not ſo natural nor eaſy neither.

DEFINITIONS.

I. If an infinite Right-line, as *x* S Z, having one Part of it, as S, fix'd there, as in an immoveable Point, plac'd above the Plane of the Circle V X Y ; be ſuppoſed to move round the Circumference of the ſaid Circle ; the Revolution of this Line *x* S X Z, will produce or form what we call a *Conick Surface* ; and if the Line be continued each way beyond the immoveable Point S, it will generate two Conick Surfaces, which are called *Oppoſite*.

Fig. 1.



II. The fix'd Point S, is called the *Vertex of either Surface*.

III. The ⊙ V X Y, is called the Baſe of the Cone V X Y S ; and the ⊙ *u x y* S, the Baſe of the oppoſite Cone.

IV. For the Solid contain'd under the Baſe V X Y, and that Conick Surface which is generated by the Motion of the Line S X, is called a *Cone*.

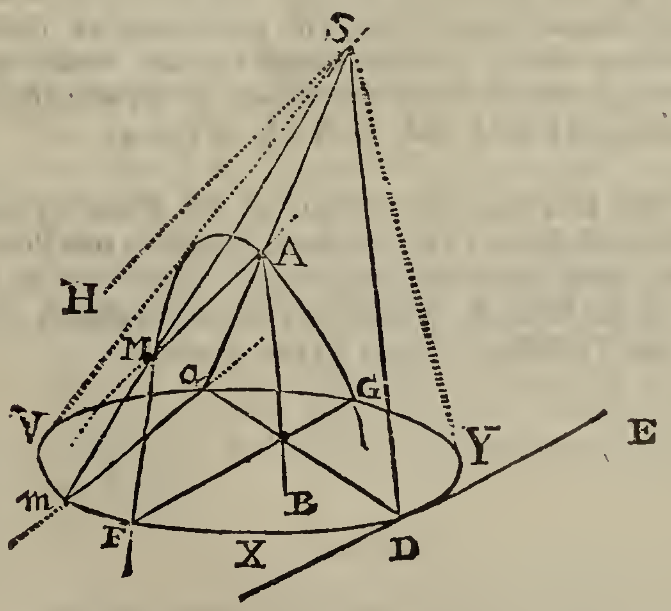
V. The Right-line S X, drawn from the Vertex to any Point in the Periphery of the Baſe, is called the *Side* (becauſe 'tis one of the Sides of the △, which will be formed by cutting the Cone thro' the Vertex, and by the Axis).

VI. The Line S O, drawn from the Centre of the Circle of the Baſe, thro' the Vertex, is called the *Axis*.

VII. A *Right Cone* is that whoſe Axis is normal to the Plane of its Baſe ; but if it be not ſo, 'tis called a *Scalene Cone*.

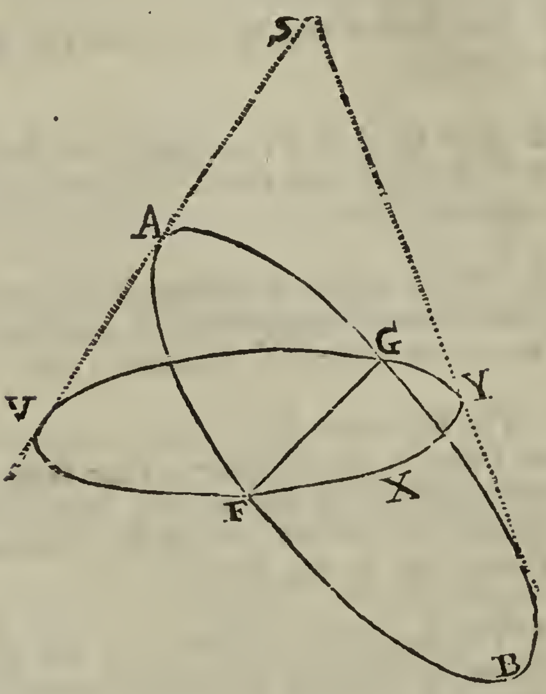
VIII. If a *Conick Surface* be cut by a Plane, which doth not paſs thro' its Vertex, as F A G ; and which alſo is not parallel to the Plane of the Baſe, (for then a Circle will be produced, which tho' truly a *Conick Section*, is not here conſider'd) the Curve-line formed by the Interſection of the Plane F A G, with the Conick Surface, is called *Conick Section*.

Fig. 2.



IX. If thro' the Vertex S, a Plane be drawn parallel to any Conick Section, the infinite Right-Line D E, which is the common Section of that Plane, with the Plane of the Baſe, is called the *Directrix.*

Fig. 3.



X. A *Conick Section* F A G, is called a *Parabola,* when the Directrix D E touches the Circle of the Baſe of the Cone (as in *Fig.* 2.); an Ellipſis, when the Directrix falls all without the Cone; and an Hyperbola, when the Directrix cuts the Circle of the Baſe.

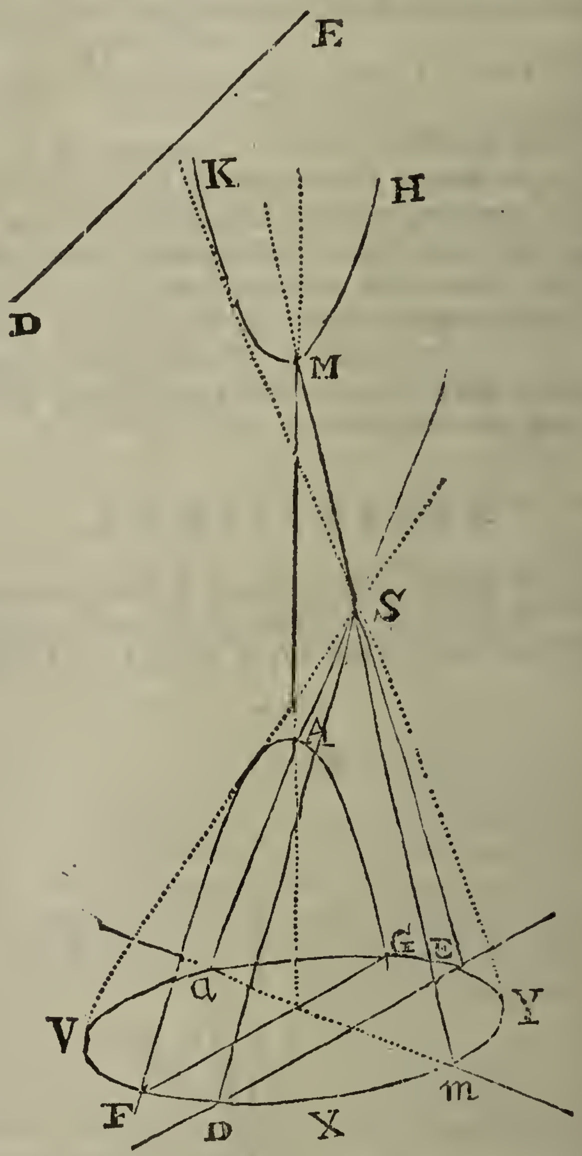
But in this laſt Caſe, if the Plane of the *Conick Section* be produced, it muſt cut the oppoſite Conick Surface, and there will form another *Conick Section,* which is called *Oppoſite*; and both together, are called *Oppoſite Sections,* or *Oppoſite Hyperbola's,* as F A G and K N H, in *Fig.* 4.

XI. If a Line be drawn in the Plane of any *Conick Sections,* ſo that it meet it only in one Point, and being produced both ways, enters not at all into the Section, but falls all entirely without, that Line is called a *Tangent* in that Point.

CONSECTARIES.

I. In the *Parabola,* all the Sides of the Cone (*vid. Def.* 5.) being produced infinitely, muſt neceſſarily cut its Plane, except the Side S D, drawn from the Vertex S to the Point D, where the Directrix touches the Baſe; becauſe no other Side but that can be in the Plane D S E, which is parallel to the Section; and that all the others cut it in the Point S: Whence it is plain, that the Parabola will be extended infinitely, and can never return into itſelf.

Fig. 4.



II. In the *Ellipſis,* all the Sides of the Cone, when produc'd, muſt cut the Plane of the Section; becauſe the Plane S D E, which is parallel to it, is cut by all of them in the Point S (*Fig.* 3.): Whence this Section muſt include a Space, and return into itſelf.

III. In the *Hyperbola* and the *Oppoſite Sections,* all the Sides of the Cone (but S D, S E, drawn from the Vertex to the Points D, E, where the Directrix cuts the Baſe) being infinitely produced both ways, from the Vertex S, muſt cut the Planes of the Oppoſite Sections; becauſe there are no other but thoſe two Sides, which can fall in the Plane S D E, which is parallel to the Sections; and alſo, becauſe all the others cut it in the Point S.

The Sides of the Portion SDVE, form the Points of the Hyperbola FAG; and thoſe of the Portion SDYE being produced on the other Side of the Vertex S, form the Points of the oppoſite Sections KMH.

And from hence 'tis clear, That the oppoſite Hyperbola's are extended infinitely, and can no more return into themſelves than the Parabolick Section.

THEOREM I.

Prop. I.

If the two oppoſite Conick Surfaces be cut, by a Plane paſſing thro' the Vertex, as S *a m* (in *Fig.* 4.) the Interſection of that Plane, with the two Surfaces, will make two Right-lines, S *a*, S *m*, which may be ſuppoſed to be infinitely produced, each way, from S.

For, let *a m* be the Common Section of this Plane with that of the Baſe, 'tis plain it will cut the Periphery of the Baſe in the two Points *a* and *m*, becauſe the Plane S *a m* is ſuppoſed to fall within the Cone: Wherefore the Sides S *a* and S *m* being produced each way from S, muſt be the two common Sections of the interſecting Plane S *a m*, with the oppoſite Conick Surfaces; as appears from the manner of their Generation, in *Def.* 1. *Q. E. D.*

CONSECTARIES.

I. As that Part of the Line *a m* joining the two Points, *a*, *m*, in the Periphery of the Baſe, falls within the Baſe, and all the reſt of it, if produced, falls without; ſo it follows, that if the Plane S *a m*, be ſuppoſed exfinitely extended all round S, that Part of it only which is contained within the Legs of the Angle *a* S *m*, and its Vertical one beyond S, will fall within the two oppoſite Conick Surfaces, and all the reſt of it without them.

II. From whence it follows, That if you join any two Points, as AM, in a Conick Section, (*Fig.* 2.) it will be all contained within the Section, and all Parts of it, when produced either way, will fall without it: For, drawing from the Vertex S two Lines, as S *m*, S *a*, and ſuppoſing them to determine ſuch a Plane as above, 'tis plain the Line AM will fall all within the Legs of the Angle *a* S *m*, *&c.*

III. Wherefore any Line paſſing thro' the Vertex S, and parallel to ſuch a Line as AM, drawn within the Section, will fall without the Conick Surface, and will meet the Plane of the Baſe produced without the Circumference of the Baſe of the Cone.

IV. It follows alſo (from *Conſect.* I.) That any two Points, one in each of the oppoſite Hyperbola's, (*Fig.* 4.) being joined by a Right-line, as AM, that Line will be wholly without, and between the oppoſite Sections; but infinitely produced each way, will be ever after entirely within the oppoſite Hyperbola's: For, drawing thro' S, the Lines S *a*, S *m*, paſſing thro' the Points A, M, and ſuppoſing them to determine a Plane, extended every way from S, *&c.* it is evident, that that Part of the Plane which is contained within the Legs of the Angle SA, SM, where the Line AM falls, is comprehended between thoſe two Surfaces; and that Part of the ſame Plane which is contained between the Productions of the Line AM, from A and M each way, will fall all of it within the oppoſite Hyperbola's.

V. From the 2d and 4th *Conſectaries*, it will follow, that a Right-line can't cut a Conick Section, or the oppoſite Hyperbola's, in more than two Points.

Prop. II.

If either of the oppoſite Conick Surfaces be cut by a Plane, as o u x y, (*ſee* Fig. 1.) *which is parallel to the Baſe* OVXY, *the Section will be a Circle, whoſe Centre ſhall be in* o, *the Point where that Plane cuts the Axis produced, as far as is neceſſary, beyond* S.

For in the Baſe, drawing any where a Radius, OX; and from the Vertex S, the Side SX; which produced, ſhall meet the Plane *o u x y* in *x*; the Lines OX and *o x* will be parallel: And the Plane SOX being produced into the oppoſite Cone beyond S, the Triangles, SOX and S *o x*, will be equal; and therefore 'twill always be, that SO:OX::S*o*:S*x*. But the two firſt Terms being always the ſame, the 4th Term, S *x*, cannot change its Length, let the Point *x* fall where it will: Wherefore the Curve *u x y* is a Circle.

Prop. III.

If in the Plane of a Parabola, as FAG (Fig. 2.) *you draw from any Point, as* A, *within the Cone, an infinite Right-line, as* AB, *parallel to the Side* SD: *I ſay, that Line ſhall always be within the Section; and tho' infinitely produced towards* B, *can never cut the Parabolick Circumference any more.*

For drawing, or ſuppoſing to paſs through the Vertex S, and the Line AB, a Plane, as SAB; that will, by its Interſection with the Conick Surface form two Sides; one of which ſhall always be the Line SD, (becauſe AB is parallel to it) and the other the Line S *a*, which paſſes through the Point A. But the Plane DS *a*, contained between the Sides SD, S *a*, produced infinitely from D and *a*, will all fall within the Surface of the Cone (by *Conſ.* I. *Prop.* I.): Wherefore the Line AB: which is always within that Plane, and is parallel to the Side SD, will fall all of it within the Parabola, and can cut its Circumference no where but in B.

Prop. IV.

A Line drawn in the Parabola FAG, *from any Point, as* A, *within the Cone, and not parallel to the Side* SD, *will, if produced, meet the Parabola in another Point, as* M. (*See* Fig. 2.)

For if you ſuppoſe a Plane to paſs along that Line and the Vertex S, as SAM, that will be all of it within the Conick Surface, and cannot paſs by the Side SD: Whence it follows, that this Plane will form, by its cutting the Surface of the Cone, the two Sides, S *a* and S *m*, (ſee *Prop.* I.) one of which, S *a*, paſſes thro' the Point A; and the other, S *m*, is by no means parallel to the Plane of the Section; for, by the Nature of it, only

only the Side S D is ſo (ſee *Def.* X.): Wherefore the Side S *m* produced, muſt cut the Plane of the Parabola in the Point M; thro' which the Line A M paſſes, which is formed by the Interſection of the Plane *a* S *m*, with that of the Parabola. But 'tis plain, that this Point M is one of the Points of the Parabola F A G, becauſe 'tis both in the Plane of the Section, and alſo in the Surface of the Cone: Wherefore, *&c.*

Prop. V.

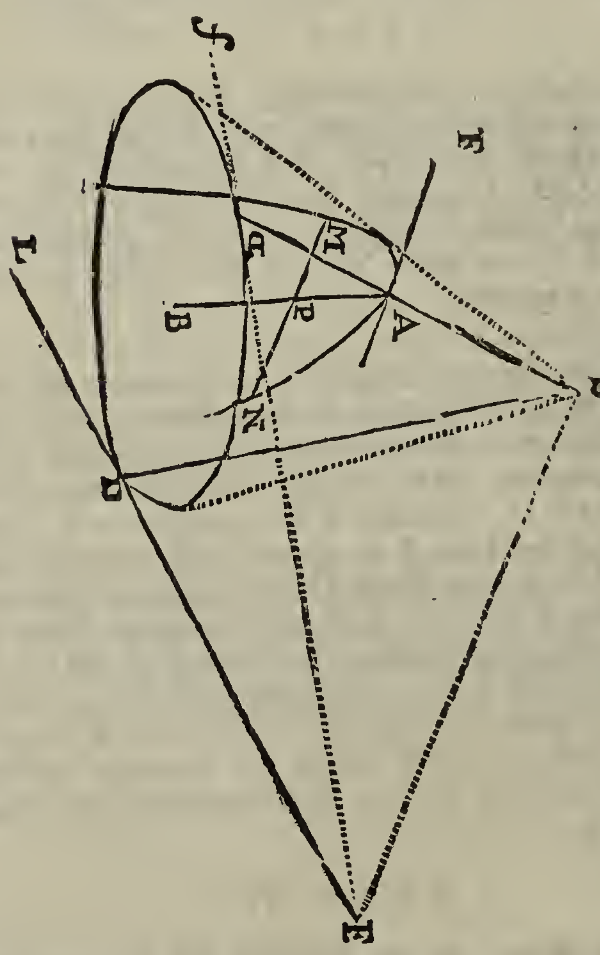
Probl. I.

Thro' a Point given, as A, *in any Conick Section, to draw a Tangent, as* A F, *to the Curve.*

Having drawn thro' the given Point A, and the Vertex of the Cone, as S, a Right-line, as S A, cutting the Baſe in *a*; and then to the Periphery of the Baſe in the ſame Point *a*, a Tangent, as E *a* F. The Line F A, made by the common Section of the Plane S E, *a f*, (produced, if neceſſary, beyond the Vertex S) with the Plane of the Section, ſhall be the Tangent required.

For, ſince the Tangent E *a f* is entirely without the Baſe, but only in the Point *a*, it follows, that the Plane S E *a f*, infinitely produced above or below S, can cut the oppoſite Conick Surface no where but in the Line S *a*, produced alſo infinitely either way; and that all the reſt of that Plane will be without thoſe Surfaces. Wherefore the Line A F, made by the Interſection of that Plane with that of the Section, can interfere with neither of thoſe Surfaces but only in the Point A, where the Line S *a* cuts the Plane of the Section: Wherefore 'tis a true Tangent to the Curve in that Point.

Fig. 5.



CONSECTARIES.

I. As there can be but one Tangent to the Periphery of the Baſe in the Point *a*, ſo there can be but one to the Point A drawn in any of the Conick Sections.

II. Whence ariſes the Way of drawing a Tangent, as A F parallel; a Right-line, as M N, given in Poſition, in the Plane of any Conick Section; or in the two oppoſite Sections.

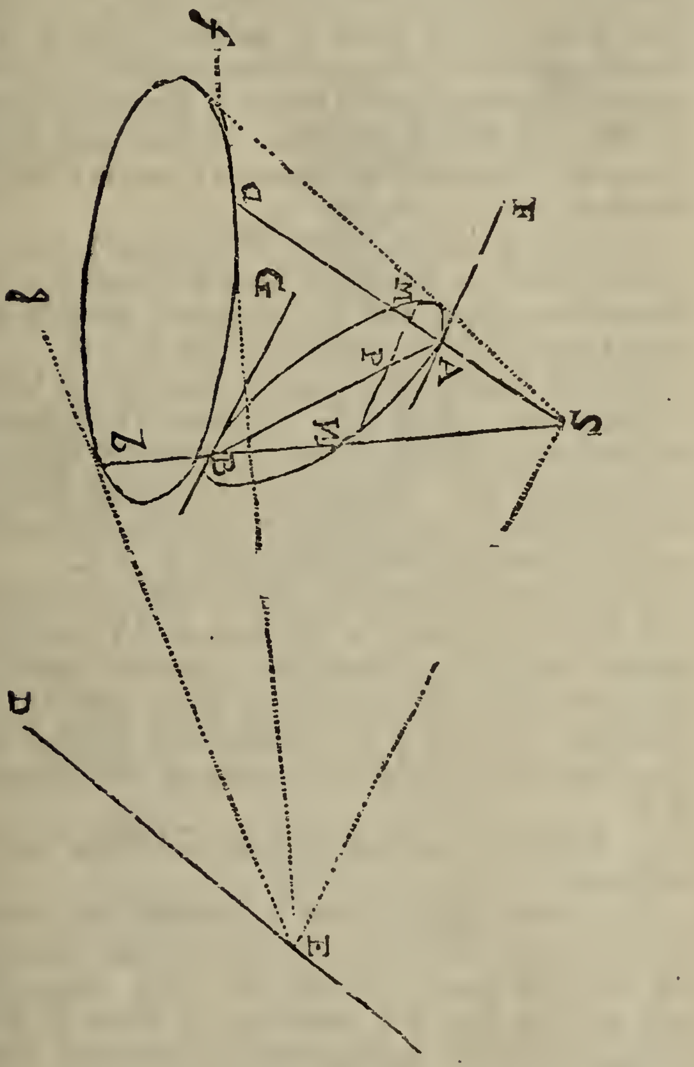
For having drawn thro' the Vertex S, a parallel to M N, as S E, that will either meet with the Directrix in ſome Point, as E, or be parallel to it; becauſe that Line S E may be parallel to the Plane of the Section, and conſequently may fall in the Plane S D E. If it cut it in any Point, as E, falling without the Baſe of the Cone; then drawing from the Point E, to the Periphery of the Baſe, the Tangent E *a f*; 'tis plain, that the Plane S E *a f* will make, by its Interſection with the Plane of the Section, a Tangent, as A F, which ſhall be parallel to the Line M N; becauſe the two Sections, A F, S E, of the parallel Planes, M A N, S E D; being cut by the Tangent Plane, S E *a f*, muſt be parallel to one another, as well as S E and M N.

III. The ſame things being ſuppoſed, as in the preceding *Conſectary*, and *Fig.* 5. it will follow, 1. That in the Parabola this Problem will be impoſſible, when the Line M N is in a parallel Poſition to the Side S D; drawing thro' the Point D, where the Directrix touches the Periphery of the Baſe; for then the Points E and D will be coincident; and thro' that Point D, no Tangent but D E can be drawn: And as the Plane which paſſes the Vertex S, and the Directrix E D, is parallel to the Plane of the Section (by *Def.* 9.) by its Interſection with the Plane of the Parabola, no Tangent can be formed: But when the Line given in Poſition is not parallel to the Side S D, a Tangent, as A F, may always be drawn parallel to it; for then the Point E falling without the circular Baſe of the Cone, two Tangents, as E *a f* and E D L, may always be drawn from that Point to the Circumference of that Circle; of which one, E D L, will coincide with the Directrix; and the other, E *a f*, will find, by the Interſection of the Plane S E *a f* with that of the Parabola, a Tangent, as A F, which ſhall anſwer the Problem.

'Tis the ſame thing when the Line S E is parallel to the Directrix; for then the Tangent E *a f* will always be parallel to the Directrix: And as there is but one Tangent that can be drawn parallel to it, becauſe the Directrix itſelf touches the Baſe of the Point D; it follows, that a Tangent may be drawn, *&c.*

2. In the Ellipſis, there may always be drawn two Tangents, A F, G B, parallel to the Right-line M N, given in Poſition, and conſequently to one another.

Fig. 6.

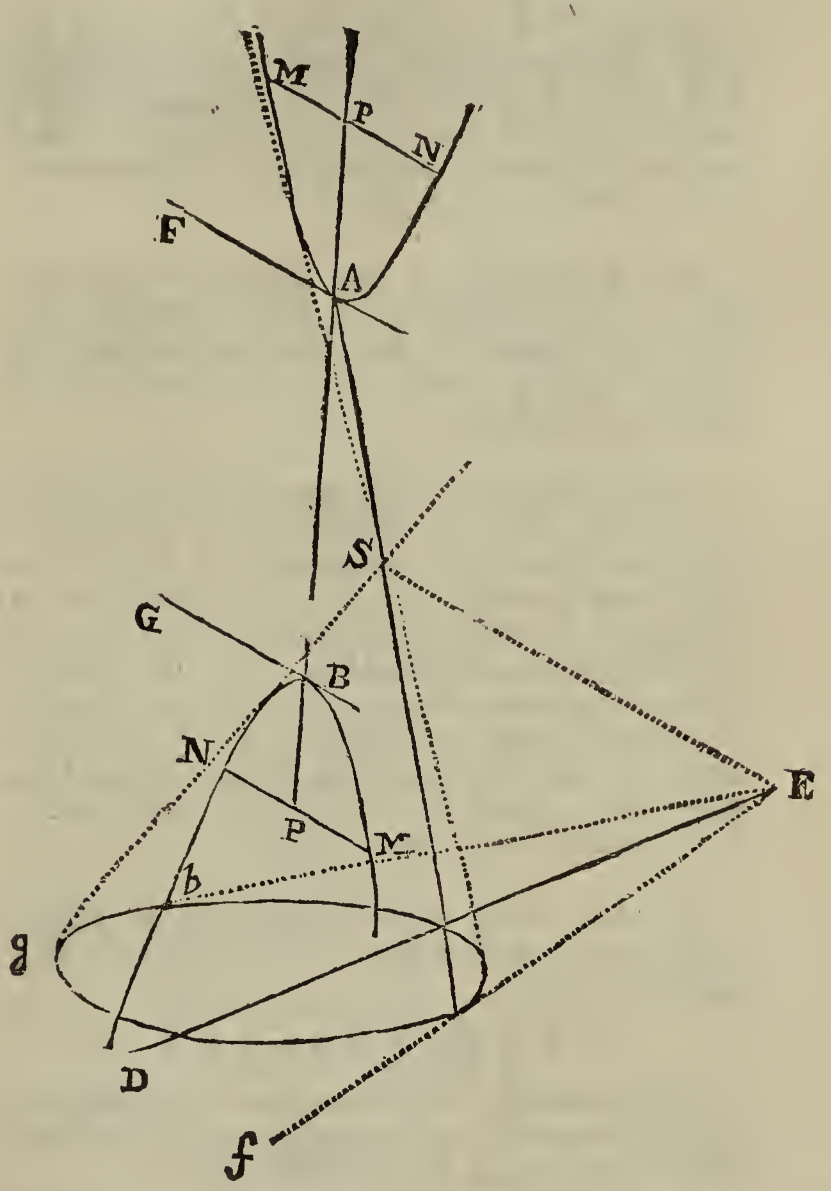


For here all the Points of the Directrix D E fall without the Baſe of the Cone; and therefore you may always draw from the Point E, two Tangents, E *a f*, and E *b g*, to the Circle of the Baſe; and theſe will ſerve, by the Interſection of the Planes, S E *a f*, and S E *b g*, with the Plane of the Section on two Tangents, A F and B G, which will anſwer the Problem.

'Tis the ſame thing when the Line S E is parallel to the Directrix; for then, inſtead of the Tangents E *a f*, E *b g*, going from the Point E in that Directrix, you need only draw two parallel Tangents, which is always poſſible.

In the Hyperbola and oppoſite Sections, the Problem becomes impoſſible, when the Point E falls within the circular Baſe of the Cone; becauſe then no Tangent can be drawn to the Point of the Baſe. But when it falls without, you may always draw two Tangents, A F and A B, parallel to the Line M N given in Poſition: For the Directrix D E, cutting the Baſe, you may always draw from the Point E, two Tangents, as E *a f* and E *b g*, to the Baſe; and which falling on each Side of the Directrix, will make, by the Interſection of the Planes, S E *a f*, S E *b g*, with the Planes of the Sections, two Tangents, A F and B G, which will anſwer the Problem.

Fig. 7.



And 'tis the ſame, when the Line S E is parallel to the Directrix D E; for then, inſtead of the two Tangents, E *a f*, and E *b o*, you need only draw two Tangents parallel to the Directrix; which is always poſſible.

And here note, That in this Caſe the two parallel Tangents, A F and B G, will always belong to the oppoſite Sections, and never to the ſame: Which is plain; becauſe the two Tangents, E *a f* and E *b g*, drawn to the Baſe, fall on each Side the Directrix.

IV. From the laſt *Conſectary*, it follows, 1. That in the Parabola or Hyperbola, you cannot draw two Tangents which ſhall be parallel one to another; but in the Ellipſis, and in the oppoſite Sections, one Tangent being given in Poſition, (as ſuppoſe A F) you may always draw another, as G B, parallel to it. (See *Fig.* 6, 7.)

2. When the Line M N given in Poſition, is terminated by the Section, you may always draw, in the Parabola, one Tangent, which may be parallel

to it; and in the Ellipſis and oppoſite Hyperbola's, two Tangents, as A F and B G; becauſe the Line S E drawn from the Vertex, parallel to M N, will cut the Plane of the Baſe produced ſomewhere without the Circle, or elſe be parallel to it.

DEFINITIONS.

XII. In the Parabola (*vide Fig.* 5.) a Line, as A B, drawn from any Point, as A, parallel to the Side S D, which paſſes thro' the Point D, where the Directrix touches the Baſe, is called a Diameter; and the Point A its Origin.

XIII. In the Ellipſis and oppoſite Hyperbola's (*Fig.* 6, 7.) a Right-line, as A B, connecting the Points of Contact of the two parallel Tangents, A F and B G, is called a Diameter, the Points A and B its Extremities.

XIV. A Line, as M D, drawn thro' any Point, as P, of the Diameter A B produced, if there be Occaſion (*Fig.* 5, 6, 7.) terminated by the Section in the two Points M N; and alſo parallel to the Tangent A F, which paſſes thro' A, the Origin of the Diameter in the Parabola, or by one or other of the Extremities of it in the Ellipſis, or oppoſite Hyperbola's; that Line is ſaid to be an entire Ordinate to the Diameter A B, being continued on each Side the Point P, tho' its Half, as P M, or P N, is uſually called an *Ordinate*.

XV. And when the Ordinates are at Right-Angles with any Diameter, that Diameter is then called the *Axis*.

CONSECTARIES.

I. From *Def.* 12. it follows, that in the Parabola all the Diameters muſt be parallel one to another; becauſe they are all ſo to the Side S D.

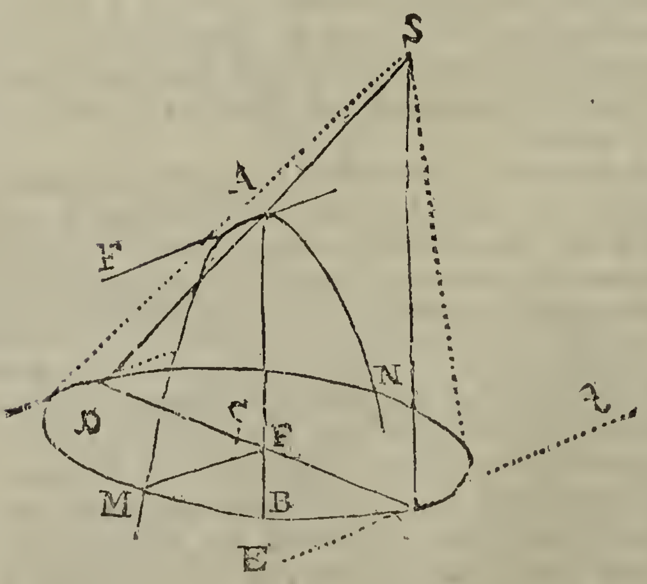
II. And that from one Point in that Section, there can go but one Diameter: For thro' one Point there can be but one Parallel drawn to any Line given in Poſition, as S D is.

PROP. VII.

Probl. II.

A Diameter, as A B, *an Ordinate,* P M, *in any Conick Section, to deſcribe the Figure.*

Fig. 8.



Thro' the Ordinate P M, deſcribe any Plane whatever, ſo it be but different from the Plane A P M, Then from the Point P, in that Plane, draw to P M, the infinite Part P *a*, and taking in that Line P *a*, any Point, as C, for a Centre, with the Radius C M, deſcribe a Circle, and 'tis done.

1. When the Section is to a Parabola, draw, from one of the Points, *a* or D, where the Circle of the Baſe cuts the Part P *a* (viz. *a*) through the Origine of the Diameter, the Right-line *a* A, which ſhall meet in the Point S, another Line, as S D, drawn parallel to A B; and then ſuppoſe a Conick Surface deſcribed, whoſe Vertex is the Point S, and its Baſe the Circle D M *a* G. I ſay, that it will form, by its Interſection with the Plane A P M, the Parabola M A N required.

For having drawn parallel to M N, and thro' the Points D and *a*, the Right-lines E D and *f a*; 'tis clear, thoſe Lines will be Tangents, becauſe they are parallel to M P, which is equal to *a* P.

But the Place S D E paſſing thro' S, the Vertex of the Cone, and thro' the Tangent D E, is parallel to the Plane A P M, becauſe S D parallel A P, and D E parallel M P: Wherefore the Section M A N, made by the Plane A P M in the Conick Surface, will be a Parabola whoſe Diameter is A B.

The Tangent Plane alſo, S *a f*, forms in the Plane A P M (by *Prop.* 5.) a Tangent, as A F, which is parallel to M N, as being the common Section of the two Planes S *a f*, A P M, which paſs by the Parallels, *a f*, P M; and conſequently (by *Def.* 14.) the Right-line P M is an Ordinate to the Diameter A B.

2. When the Section is to be an Ellipſis, or Hyperbola,

Draw through the Point *a b*, where the Infinite P *a* cuts the Circle; and through the Extremes of the Diameter A, B, the two Right-lines *a* A and B *b*, they will meet in the Point S, from whence a Conick Surface may be deſcribed, whoſe

Fig. 9.

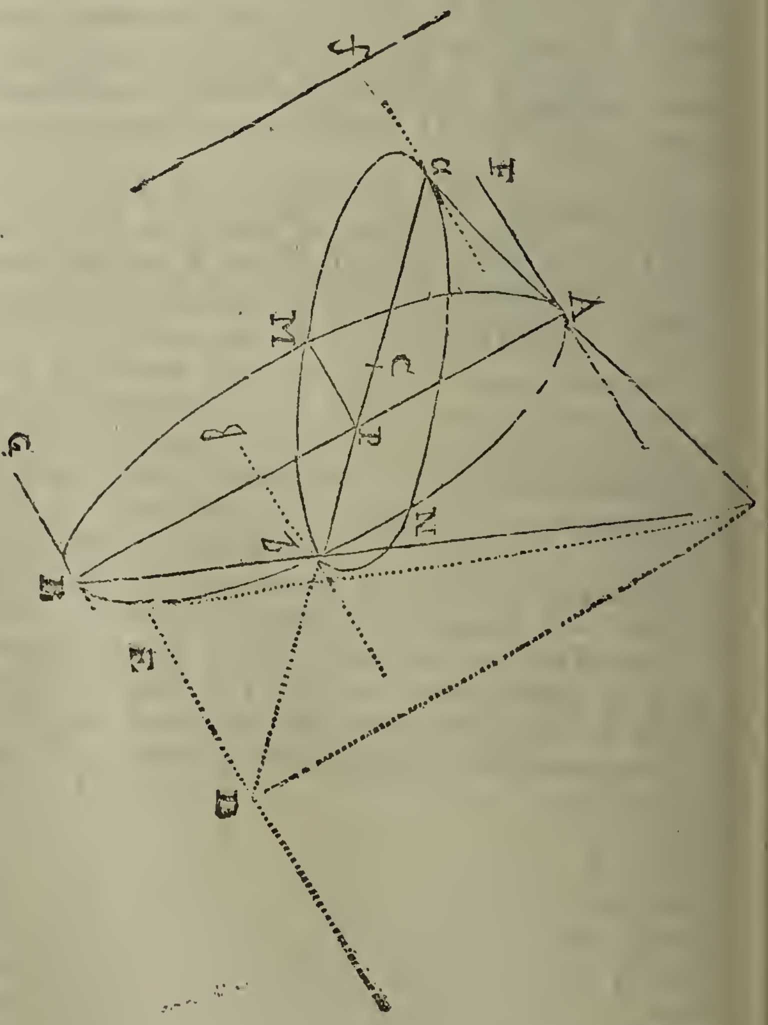
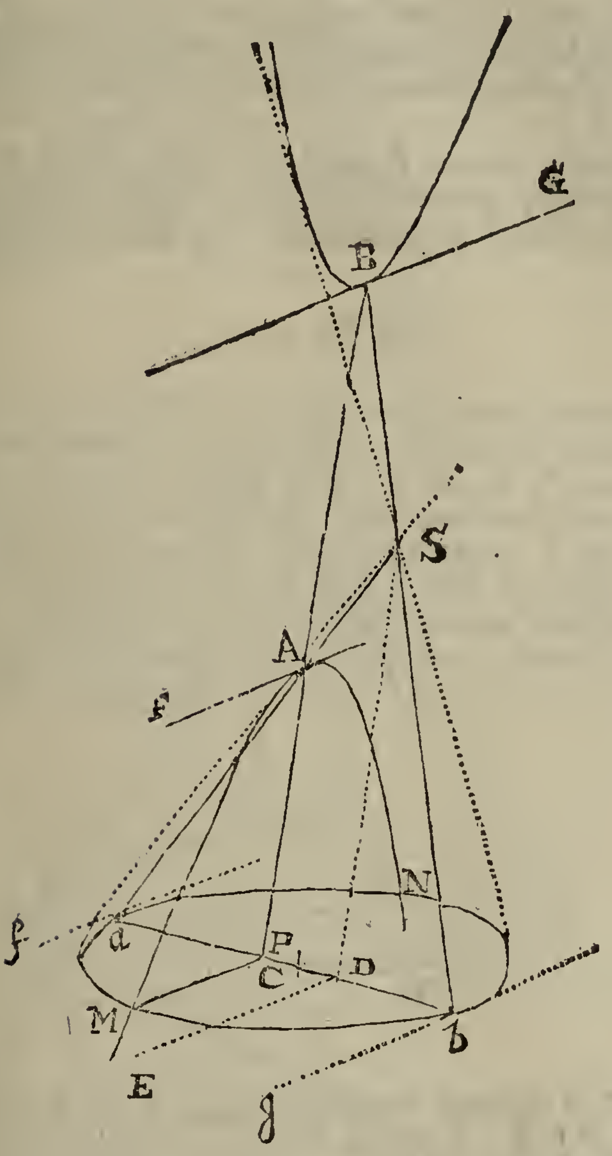


Fig: 10.



Vertex may be that Point S, and its Baſe the Circle *a* M *b* N. Then, I ſay, that the Plane A P M ſhall form, in this Conick Surface, the Section M A N required.

For drawing S D parallel to the Diameter of the Section A B, and meeting *a b* the Diameter of the Baſe, in the Point D thro' that Point, and alſo thro' *a* and *b*, draw the Parallels D E, *a f*, and *b g* to P M: Then 'tis apparent, that the Plane S D E ſhall be parallel to A P M; and that D E (by *Def.* 9.) ſhall be the Directrix.

But in the Ellipſis, the Point D falls without the Diameter *a b* produced beyond the ⊙, becauſe the Diameter of the Section A B falls within the Angle *a* S *b* made by the Sides of the Cone *a* S and S *b*. But in the Hyperbola the Point D falls within the Circle of the Baſe, becauſe then the Diameter A B falls within *a* S B; which is the Angle lying on the Side of the Angle *a* S *b*: Whence it follows, that (according to *Def.* 10.) the Section M A N will, in the former Caſe, be an Ellipſis, and, in the latter, an Hyperbola.

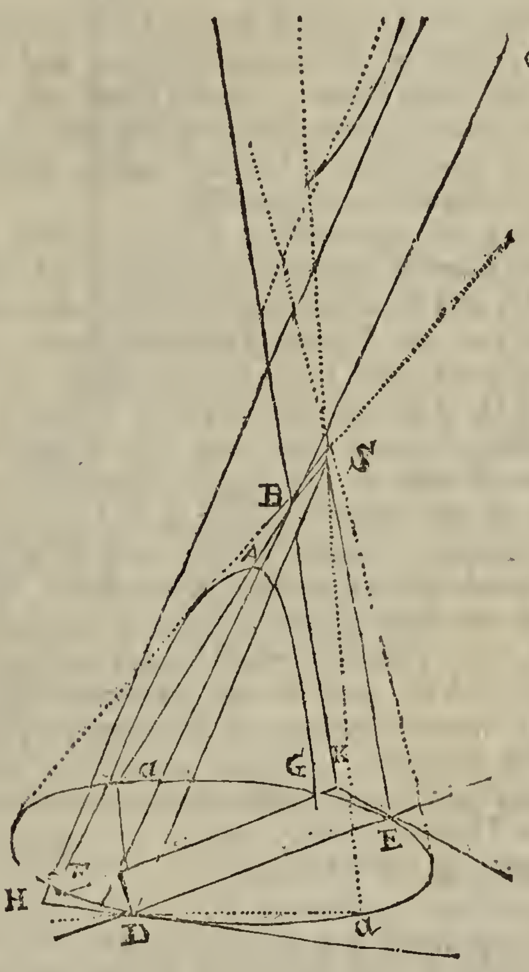
The Tangent A F paſſing thro' A, the Extremity of the Diameter A B; being the common Section of the Tangent Plane S *a f*, and the interſecting Plane A P M, which paſſes thro' the Parallel *a f* and P M, will be parallel to the Ordinate P M; and for the ſame Reaſon alſo, the Tangent B G will be parallel to P M, for that is the common Section of the Tangent Plane S *b g*, and the Secant Plane A M P, which paſs by the two Parallels *b g* and P M, ſhall be parallel to P M. Whereſore the Line A B (by *Def.* 13, 14.) is a Diameter, whoſe Ordinate is P M.

It may happen in the Ellipſis, that the Line A *a* and *b* B may be parallel to one another; but there can be but only one Point in the Line *a b* for C, the Centre of the Circle of the Baſe.

DEFINITION XVI.

If thro' the Point D and E in the Hyperbola, where the Directrix cuts the Baſe of the Cone, you draw the Tangents D H and E K; and thro' the Vertex S, and thoſe Tangents, you draw two Planes, S D H and S E K; which ſhall cut the Surface of the Cone in the Right-line C H and C K infinitely produced: Then are thoſe Lines, C H and C K, called Aſſymptotes.

Fig. 11.



CONSECTARY I.

If thro' any Point of Contact of the Baſe of the Cone, as D, you draw thro' the Vertex S, the Side or Right-line D S, infinitely produced: 'Tis then plain, that the Tangent Plane, S D H, can have nothing common with the oppoſite Conick Surfaces, but the Side S D, becauſe the Points of the Tangent D H fall without the Periphery of the Baſe of the Cone, but only D. But the Plane S D E paſſing thro' the Vertex S, and the Directrix D E, being parallel to the Planes of the oppoſite Sections; the common Sections, S D and C H of thoſe Planes, with the ſame Plane S D H, muſt be parallel to one another: And therefore the Aſſymptote C H muſt fall entirely without and between their oppoſite Conick Surfaces; and conſequently muſt leave the oppoſite Hyperbola's on each Side entirely, without ever touching them or meeting with them. And the ſame thing may be ſhewn of the other Aſſymptotes C K: But as two Aſſymptotes C H, C K, are formed by the Plane S D H, S E K, which fall on each Side of the ſame Conick Surface, and its oppoſite; it follows, that all the Points of the Hyperbola FAG are contained within the Angle HCK; and all Points of the oppoſite Section within its vertically oppoſite Angle.

PROP. VII.

If thro' any Point, as B, *in the Aſſymptote* CK, *you draw a Line, as* BA, *parallel to the other Aſſymptote* CH; *I ſay, that it ſhall interſect one of the oppoſite Hyperbola's in one only Point, as* A: *and being produced infinitely, will be always within it.* See *Fig.* 12.

For, ſince the Lines BA and SD are parallel to CH, they muſt be ſo to one another, and ſo are both in the ſame Plane; which Plane will enter within the two Conick Surfaces, becauſe it paſſes by one of their Sides SD, and makes an Angle with the Tangent Plane SDH.

The Plane of the Parallels BA, SD, will form in the two Conick Surfaces two Sides; of which, one is SD, and the other the Side S*a*, which muſt neceſſarily cut the Line BA in ſome Point, as A; becauſe it lies in the Plane which paſſes thro' the Parallels SD, AB, and which enters SD in S.

Wherefore, becauſe the Point A is found at the ſame time in one of the Conick Surfaces, and in the Plane of the Hyperbola's, it muſt be in one of thoſe Hyperbolæ. And ſince the Line BA being infinitely produced on the Side of the Point A, falls entirely in the Plane DS*a*, contained between the Sides DS, S*a*: Therefore the Point A will be in the Hyperbola FAG, and in the vertically oppoſite one ASD, when it belongs to the oppoſite Hyperbola: 'Tis apparent, it muſt always fall within one of the two Conick Surfaces; and conſequently within the Hyperbola alſo, which is contained in the Section. *Q. E. D.*

CONSECTARY.

From hence 'tis plain, that between the Hyperbola FAG, and its Aſſymptote CH, no Line can be drawn parallel to that Aſſymptote.

But as the Line AB divides the Hyperbola, which it cuts into two indefinite Portions, of which one muſt fall entirely within the Space contained between the two Parellels BA and CH; it follows, that the leſſer CB becomes, the more or farther the Point A will get into that Space, and this ſtill more and more, till CB become leſs than any Quantity: That is, the Hyperbola and its Aſſymptote will approach ſtill nearer and nearer towards one another; ſo that their Diſtance will be leſs than any aſſignable Length, and yet can never meet, by *Cor.* 1. of *Def.* 16.

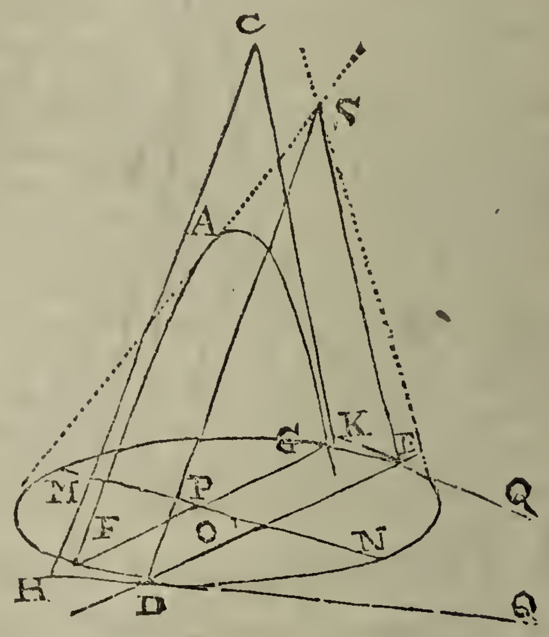
PROP. VIII.

Problem.

CH *and* CK, *the Aſſymptotes of an Hyperbola*, FAG, *being given, and any Point in the Curve, as* F, *to deſcribe the Hyperbola.*

Having drawn through the given Point F any Right-line, as HK, cutting the Aſſymptotes, make a Plane to paſs through that Line, any how, (ſo it be different from the Plane of the Aſſymptotes HCK) in which Plane draw through P the middle Point in HK an infinite Perpendicular, as MN. Then on any Point of it, as O, as a Centre, and with the Radius OF, deſcribe the Circle FMN. Then draw through the Points H and K two Tangents to the Circle; and through their Points of Contact DE, draw DS, ES, parallel to the given Aſſymptotes CH and CK. Theſe will meet in a Point, as S; from which, as from a Vertex, if you deſcribe a Conick Surface, whoſe Baſe ſhall be the Circle FMN; I ſay, this Conick Surface ſhall, by the Interſection of the Plane HCK, form the Hyperbola FAG; which was required. For,

Fig. 12.



1. 'Tis clear, from the Property of the Circle, that the Chord FG is biſſected in the Point P, by the Diameter MN, which is perpendicular to it. Wherefore ſince $PH = PK$ (by the Conſtruction) FH muſt be $= GK$, and $GH = FK$; and conſequently $GH \times HF = FK \times KG$.

2. From the Circle alſo it follows, that $GH \times HF = \overline{HD}^2$, and $FK \times KG = \overline{KE}^2$; and conſequently $HD = KE$.

3. If the Tangents HD and KE are produced, till they meet in the Point Q, DQ will be $=$ EQ.

Wherefore $DQ : EQ :: HD : KE$.

Whence it will follow, that the Line DE joining the two Points of Contact, is parallel to the Line HK; and the Plane SDE to the Plane CHK: And therefore the Line DE is the Directrix, (by *Def.* IX.) and as it cuts the Baſe in two Points, the Section FAG will be an Hyperbola, by *Def.* X.

'Tis plain alſo, that this Hyperbola muſt paſs through the Point F, ſince that Point is common both to the Conick Surface, and to the Plane HCK, which is that of the Hyperbola; and that Hyperbola ſhall have the Lines CH, CK for its Aſſymptotes, becauſe they are the common Sections of the Tangent Planes SDH, SEK, with the Plane of the Hyperbola (*Def.* XV.)

When it happens that the Tangents DH, EK are parallel, then will alſo the Lines DE, HK be parallel.

PROP. IX.

If two Right-lines, as MN, AB, *terminate within any Conick Section, or within the oppoſite Sections, do interſect each other in a Point, as* P; *and if they be parallel to any two other Right-lines, as* SE, SD, *which are given in Poſition: I ſay, the Rectangle* MPN *is to that of* APB, *always in a given Ratio; or the Ratio between theſe Rectangles will always be the ſame, let the Lines* MN, AB, *lie where they are.*

Fig. 13.

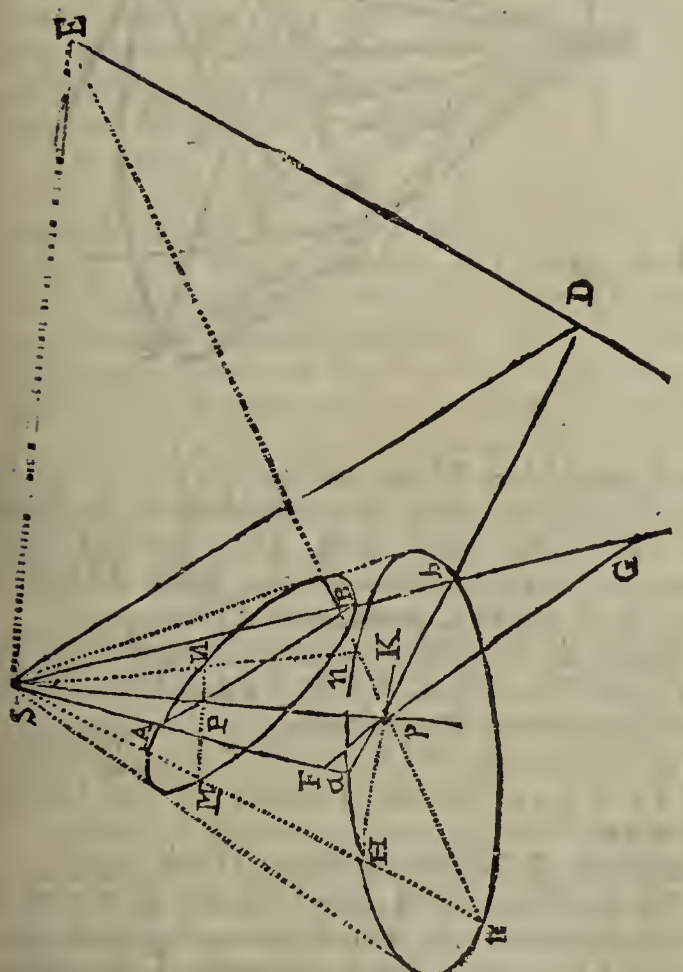
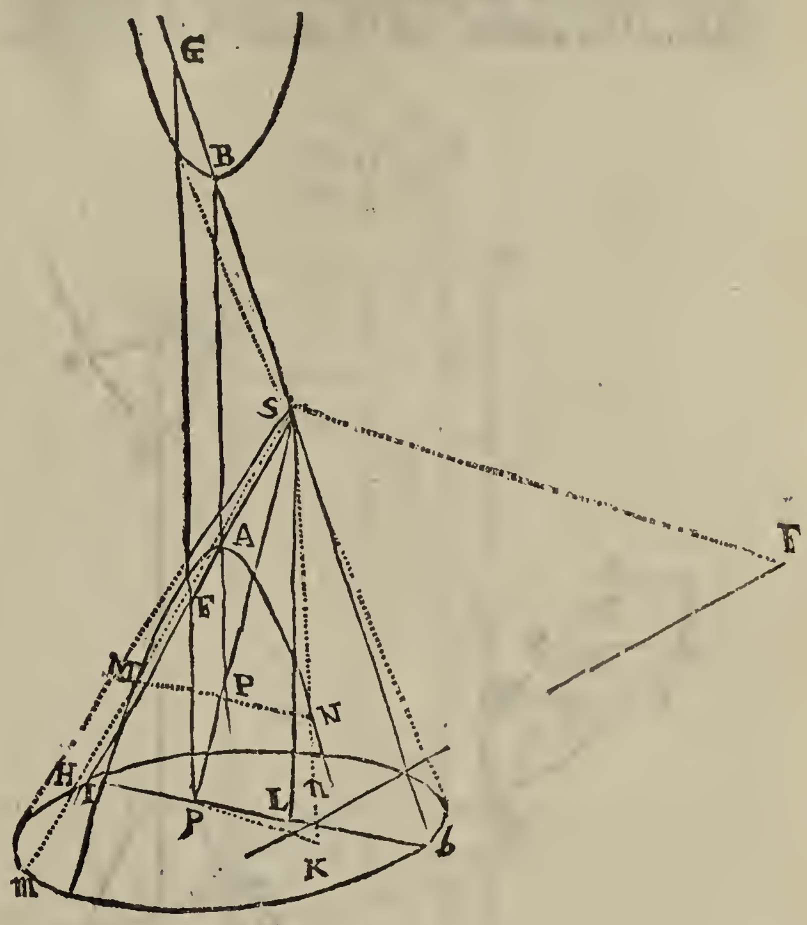


Fig. 14.



DEMONSTRATION.

Drawing thro' the Parallels SE, MN, and SD, AB, two Planes, their Interſection with the Plane of the Baſe will form the two Right-lines E*nm*, D*ba*; and, in the Conick Surface, the Sides SM*m*, SN*n*, SA*a*, SB*b*: And their common Interſection will be the Line SP*p*, which meets the Plane of the Baſe in the Point *p*, being the Interſection of the two Lines E*m* and D*a*. Thro' that Point *p* then, and in the Plane SMN, draw the Line HK parallel to MN, and in the Plane SAB, draw FG parallel to AB.

Then the ſimilar Triangles SPM, S*p*H, SPN, S*p*K, SPA, S*p*F, SPB, S*p*G; will give theſe Proportions: That the ▯ MPN, ▯ H*p*K : : SP^2 SP^2 : : ▯ APB, ▯ F*p*G. Alſo the ▯ MPA, ▯ APB : : ▯ H*p*K ▯ F*pg*: But the Ratio of the ▯ H*p*K to ▯ F*p*G, is compounded of two Ratio's of H*p* × *p*K to *mp* × *pn*; and of *mp* × *pn*; or by the Property of the Circle *ap* × *pb* to F*p* × *p*G.

But becauſe of the ſimilar Triangles, H*pm*, SE*m*, and K*pn*, SE*n*; it will be H*p*, *mp* : : SE*m*E, and *p*K, *pn* : : SE, E*n*.

And then multiplying the Antecedents and Conſequents of thoſe Ratio's, H*p* × *p*K, *mp* × *pn* : : SE^2 *m*E × E*n*.

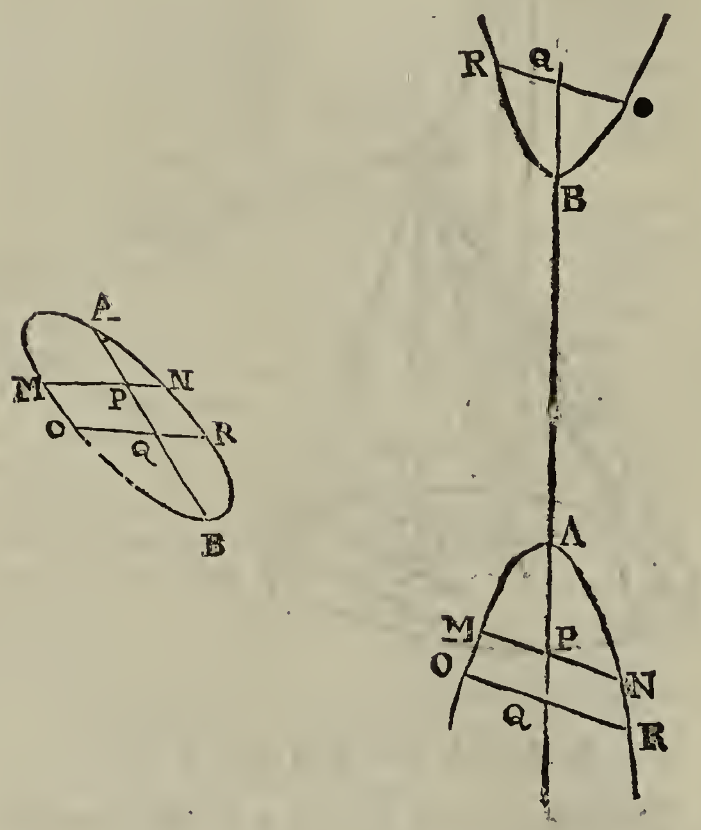
It may be proved alſo from the Similarity of the Triangles F*pa*, SD*a*, and G*pb*, SD*b*: That *ap* × *pb*, F*p* × *p*G : : *a*D × D*b* : SD^2.

'Tis evident therefore, that the Ratio of PM × PN to AP × PB, is compounded of two Ratio's of SE^2 to *m*E × *n*E, and of *a*D × D*b* to SD^2: Which, by the Property of the Circle, (which Figure the Baſe of the Cone makes) will remain always the ſame, let the Lines MN, AB, lie how they will, becauſe the Points do not change: Wherefore the Rectangle APB, is always in a given Ratio. *Q. E. D.*

CONSECTARY.

Hence you ſee, that if in any Conick Section, or in the oppoſite Sections, there be two Right-lines, MN, OR, parallel one to another; and cutting a third Line AB, which is alſo terminated within the Section; it will always be ▯ MPN ▯ OQR :: ▯ APB ▯ AQB.

Fig: 15, 16.



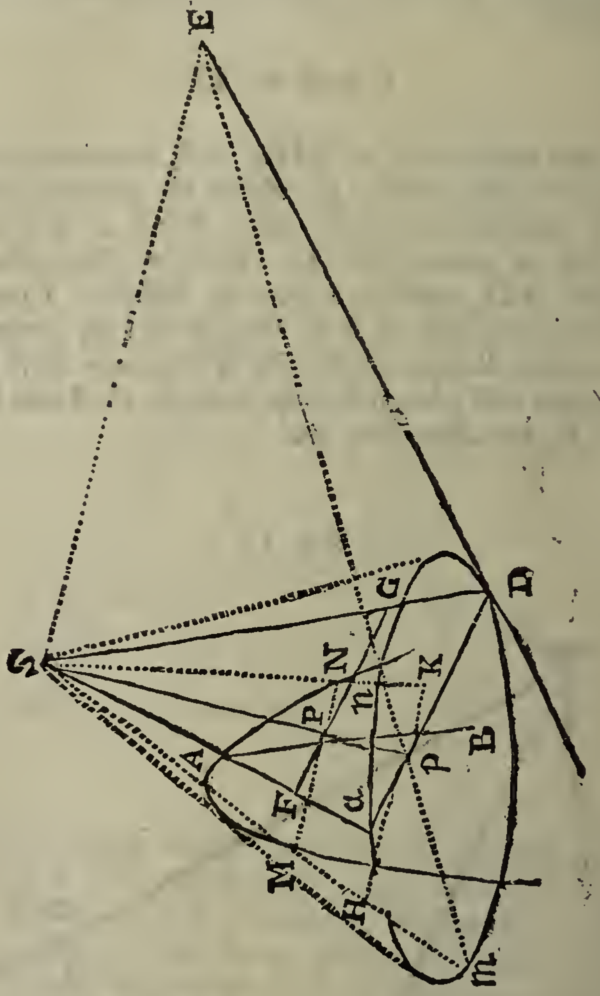
PROP. X.

If thro' any Point, as A, *of a Parabola or Hyperbola* MAN, *a Right-Line, as* AB, *be drawn parallel to the Side of the Cone* SD; *(that is, being drawn in the Parabola thro' the Point* D, *where the Directrix touches the Baſe; and in the Hyperbola thro' one of the two Points where the Directrix cuts the Baſe) : And ſuppoſe thro' any Point, as* P, *in that Line* AB, *a Right-line* MN *be drawn parallel to the Line* SE, *given in Poſition, and terminated by that Section, or the oppoſite Section : Suppoſe alſo another Right-line,* FG, *drawn parallel to the Line* Da, *the common Section of the Plane* SAB *with that of the Baſe, and terminated by the Sides* Sa, SD: *Then, I ſay, the Ratio of the Rectangle* FP × PG, *or* FPG *is given,* i. e. *it will be always the ſame, where-ever the Point* P *be taken in the Line* AB.

DEMONSTRATION.

Thro' the Parallel SE, MN, ſuppoſe a Plane to be drawn, that will form with the Baſe of the Cone, the Right-line E*nm*, in the Conick Surface, the Sides SM*m*, SN*n*, and in the Plane SD*a*; the Line SP*p*, which meets the Baſe in the Point P, where the Lines EM, DA, interſect each other. Then thro' that, in the Plane SMN, I draw the Line HK parallel to MN.

Fig. 17.



This being ſuppoſed, the ſimilar Triangles SPM, S*p*H, SPN, SPK, SPE, S*pa*, SPG, SPD, will give us theſe Propoſitions.

▯ MPN, ▯ H*pk* :: SP^2 Sp^2 :: ▯ FPG, ▯ *ap*D; or (by the Property of the Circle) ▯ *mpn*.

Alſo the ▯ MPN, FPG :: H*pk*, *mpn*.

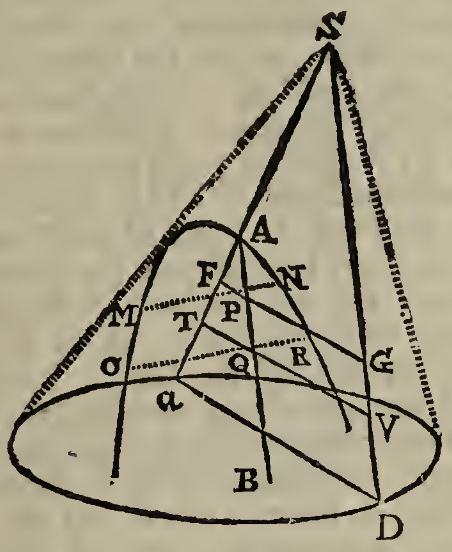
But the Ratio of ▯ H*pk* to the ▯ *mpn*, is compounded of the two Ratio's of H*p* to *pm*, and of *pk* to *pn*: That is, (becauſe of the ſimilar Triangles H*pm*, SE*m*, and K*pn*, SEN) of the two Ratio's of SE to E*m*, and of SE to E*n*; and conſequently H*p*K, *mpn*, or MPN, FPG :: SE^2 ▯ *m*E*n*.

And then, becauſe the Point E varies not, in what Place ſoever the Point *p* be taken, and ſince all the E*mn* are equal, by the Property of the Circle; it will follow, that the Rectangle MPN muſt be to ▯ FPG in a given Ratio. *Q. E. D.*

CONSECTARY.

Hence 'tis evident, that if thro' any Point, as A of an Hyperbola or Parabola, M A N, if in the latter, a Diameter, as A B; or in the former, a Parallel to one of the Aſſymptotes, as A B, be drawn, and that thro' any two Points, *a* P Q, in that Line A B, two Parallels, M N, O R, be drawn and terminated by that Section, or by the oppoſite Sections, it will always be ▯ M P N, ▯ O Q R : : A P, A Q.

Fig. 18.



For drawing the Plane S A B, forming, by its Interſection with the Conick Surface, the two Sides S D, S *a*; of which, the Side S D (if the Section be a Parabola) paſſes thro' the Point D, where the Directrix touches the Baſe; and if it be an Hyperbola, thro' one of the two Points where it cuts it; and drawing alſo, in the Plane S D *a*, thro' the Points P, Q, the Right-lines F G, T V, parallel to D *a*; 'tis plain, in the precedent Propoſition, that ▯ M P N, F P G : : O Q R, T Q V; and then alternately ▯ M P N, O Q R : : F P G, T Q V. But the Parts P G, Q V, are equal to one another; becauſe the Lines A B, S D, are parallel : And moreover, ▯ M P N, O Q R : : F P, T Q : : A P, A Q, by reaſon of the ſimilar Triangles A P F, and A Q T. Wherefore ▯ M P N muſt be to ▯ O Q R : : A P, A Q. *Q. E. D.*

After this, the noble Author, becauſe a Cylinder is a Solid leſs compounded than a Cone; for it hath all its Sides parallel one to another, inſtead of their terminating in a Point, as they do in the Cone, thinks fit to conſider the Ellipſis as a Cylindrick Section, and from thence demonſtrates the Properties of its Diameters, as alſo thoſe of the Parabola and Hyperbola.

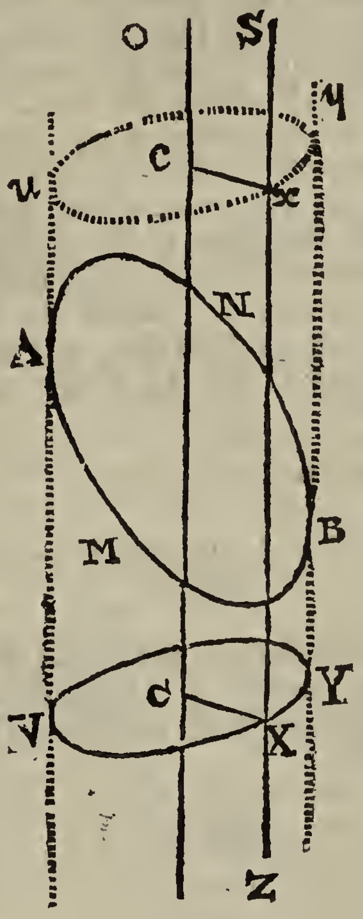
In order to which, he premiſes theſe Definitions.

Of the Ellipſis *in particular.*

DEFINITIONS.

XVII. If an infinite Right-line, as S *z*, which is without the Plane of the Circle V X Y, be moved with one of its Points X, quite round the Circumference of that Circle, and keeps always parallel to itſelf, till it come again to the Place or Point whence it ſet out; then the Convex Surface, deſcribed by the Motion of that Line, is called a *Cylindrick Surface.*

Fig. 19.



XVIII. The deſcribent Line S Z, in any kind of Poſition of its Motion round the Circumference of the dirigent Circle, is always called the *Side.*

XIX. The Circle V X Y, is called the *Baſe.*

XX. The infinite Line C O, drawn from the Centre of the Baſe C, and parallel to the Sides, is called the *Axis.*

XXI. The infinite Solid, comprehended under the Baſe V X Y, and the Cylindrick Surface, is called a *Cylinder.*

XXII. If the Cylinder be cut by a Plane, neither parallel to its Sides, nor to the Plane of the Baſe, the Curve Line A M B N, formed by the Interſection of that Plane with the Cylindrick Surface, is called a *Cylindrick Section.*

PROP. XI.

If a Cylinder be cut by a Plane, (*ſee* Fig. 147.) *as* u x y, *parallel to the Plane of its Baſe* V X Y; *the Section* u x y, *ſhall be a Circle, whoſe Centre ſhall be the Point* c, *where that Plane interſects the Axis; and its Radius ſhall be the Right-line* c x = C X, *the Radius of the Baſe.*

DEMON-

DEMONSTRATION.

For having drawn thro' any Point *x*, of the Section *u x y*, a Side, as *x* X, of the Cylindrick Surface that ſhall be parallel to the Axis C *c* (by *Def.* 20.); wherefore a Plane may be made to paſs thro' theſe two Lines, which, by its Interſection with the two parallel Planes, C V X Y and *c u x y*, will form the two Right-lines, C *x* and *c x*, parallel to one another; and which alſo might be equal to one another, becauſe they are terminated by the two parallel and equal Lines, C *c* and X *x*.

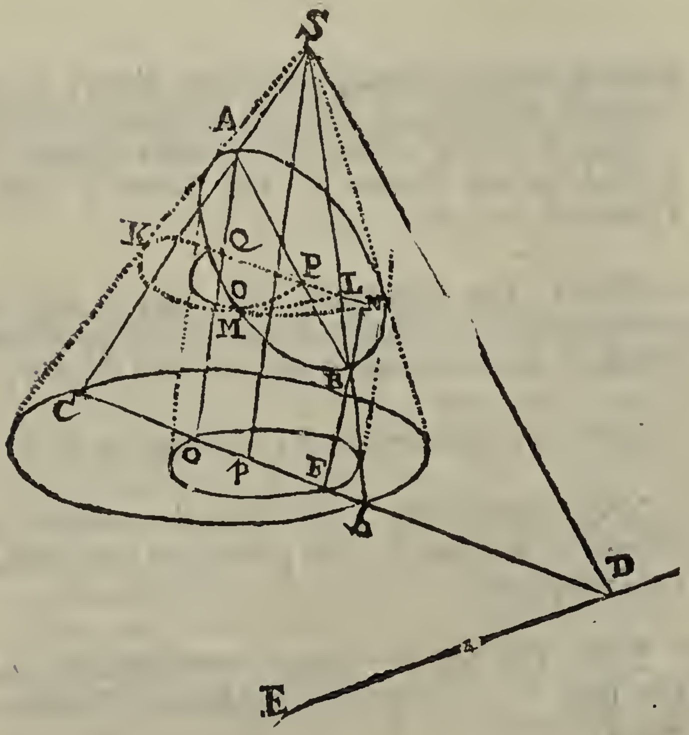
But as this muſt always be the Caſe, in what Point ſoever of the Section *u x y*, *x* be taken; it will follow, that the Lines *c x*, drawn from the Point *c*, to all the Points *x*, of the Section *u x y*, are equal to all the Radii, C X, of the Baſe; *i. e.* the Section *u x y* muſt be the Circumference of a Circle, whoſe Centre is *c*, where the Plane *u x y* cuts the Axis of the Cylinder, and its Radius is *c x*, a Line equal C X, the Radius of the Baſe. *Q. E. D.*

PROP. XII.

Every Ellipſis may be conſidered as a Cylindrick Section.

Having, in the Baſe of any Cone, where an Ellipſis is formed, draw the Diameter *a b*, which ſhall be at Right-angles in the Point D, with the Directrix D E: Let there be drawn alſo in the Conick Surface, the Sides S *a*, S *b*, meeting the Plane of the Ellipſis in the Points A and B, and draw alſo in the parallel Planes, A M B, S D E, the Right-lines, A B, S D.

Fig. 20.



Then taking D F, a mean Proportional between *a* D and D *b*; and drawing to S F, the Parallels A G, B H: Let a Circle be deſcribed on the Plane of the Baſe, whoſe Radius ſhall be G H; and on that Circle let a Cylindrick Surface be formed, whoſe Sides ſhall be A G, B H.

This done, I ſay, that if thro' any Point, as P, in the Line A B, you draw a Parallel to the Directrix D E, which ſhall cut the Conick Surface in M, and the Cylindrick in O.

Thoſe two Points, M and O, will be coincident.

For making a Plane to paſs thro' that Parallel P M, which ſhall be itſelf parallel to the Plane of the two Baſes, both of the Cone and Cylinder; it will form, by its Interſection of the Conick Surface, the Circle K M L (by *Prop.* 2.) whoſe Centre will be the common Section of that Plane, with the Axis of the Cone; and in the Cylindrick Surface, another Circle, Q M R, (by the Precedent) whoſe Centre will be the common Section of the ſame Plane S *a b* (by *Def.* 6.) paſſes thro' the Axis of the Cone; and the Plane A G H B, (which is coincident with the Plane S *a b*) paſſes thro' the Cylinder (by *Def.* 20.) and conſequently the Lines K L and Q R, which are the common Sections of thoſe two Planes, with the Plane parallel to the Baſe, and which paſſes thro' the Line P O or P M, will be the Diameter of the two Circles; and that Line P O M ſhall be Normal to thoſe Diameters, becauſe 'tis parallel to D E, which (by the Conſtruction) is Normal to *a b*, and alſo to G H, which muſt be coincident with *a b*, to which the Diameters K L and Q R (which alſo muſt be coincident) are parallel.

Moreover, the Lines, A B, S D, being formed by the Interſection of the ſame Plane, S *a b*, with two others which are parallel (and with the Plane S D E, and that of the Ellipſis) muſt be parallel to one another.

Which being well underſtood, it will follow:

1. That in the Cone, becauſe of the Circle K M L, you will have $PM = \square\, KPL$, and becauſe of the ſimilar Triangles, A P K, S D *a*, and P B L, S D *b*; you will have thoſe Proportions: A P, P K : : S D, *a* D, and P B, P L : : S D, D *b*; whence it will follow, $AP \times PB$, $KP \times PL$ (or PM^2) : : SD^2 $aD \times Db$.

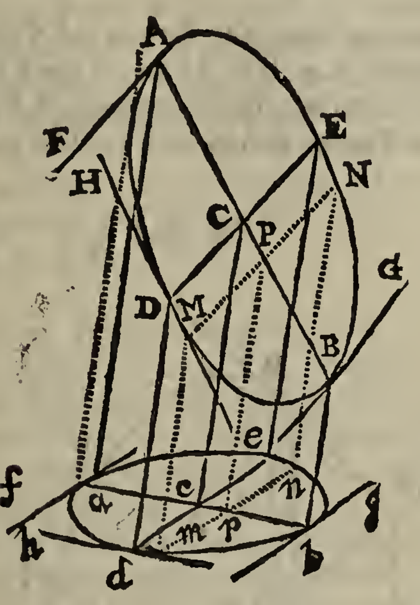
2. In the Cylinder, becauſe of the Circle Q O R, $PO^2 = \square\, QPR$, and from the ſimilar Triangles, A P Q, S D F, and P B R, S D F, theſe Proportions will ariſe, A P, Q P : : S D, D F, and P B, P R : : S D, D F: Whence it will follow, that A P, P B, $QP \times QR$ (or PO^2) : : SD^2, DF^2, (or $Da \times Db$). Wherefore $PM^2 = PO^2$; and therefore $MP = PO$, and conſequently the Points M and O will be coincident: And becauſe this will always be the Caſe, in what Part ſoever of the Line A B, the Point P be taken; it will follow, that the Plane of the Ellipſis meets, or cuts the Conick and Cylindrick Surfaces in the ſame Points; and therefore the Ellipſis may always be conſidered as a Cylindrick Section.

PROP. XIII.

All the Diameters of the Ellipſis paſs thro' one only Point: Which is that where the Plane of the Ellipſis cuts or interſects the Axis of the Cylinder, and do there biſect one another: And converſly, all Right-lines paſſing thro' that Point, and terminated at each End by the Ellipſis, are biſected in that Point, and are alſo Diameters of the Ellipſis.

They call that Point the Centre of the Ellipſis.

Fig. 21.



1. Let A B be any Diameter whatſoever; ſo let C be the Point where the Plane of the Ellipſis interſects the Axis of the Cylinder. If you draw the Lines A *a*, B *b*, parallel to the Axis C *c*, 'tis plain (by *Def.* 20.) that they will be the Sides of the Cylindrick Surface; and that the two Planes, F A *a*, G B *b*, paſſing thro' thoſe Lines, and through the Tangents A F, B G, (which, according to the Definition of the Diameter, will be parallel to one another) muſt be parallel, and muſt touch the Cylindrick Surface in the Sides A *a*, B *b*. From whence it follows, that thoſe two Planes will form in the Plane of the Baſe, the two Lines, *a f*, *b g*, parallel to each other, and Tangents to the Baſe in the Points, *a*, *b*; where the Sides, A *a*, B *b*, interſect it.

Now, from the Elements of Geometry, 'tis plain, that the Line *a b*, which connects the Points of the Contact of the two parallel Tangents, *a f*, *b c*, in any Circle, muſt paſs thro' its Centre *c*. Wherefore the Plane A *a b* B will paſs thro' the Axis of the Cylindrick; and the Line A B, which is the Interſection of the Plane with that of the Ellipſis, muſt paſs thro' the Point C, where that Axis interſects the Plane of the Ellipſis.

Again, by reaſon of the Parallels, A *a*, C *c*, B *b*, 'tis plain, that the Diameter of the Ellipſis A B is divided into two equal Parts, or biſected in C; becauſe the Diameter of the Circle of the Baſe *a b*, is biſected in its Centre *c*, which was the firſt thing to be prov'd.

2. If thro' the Extremities of any Line, as A B, paſſing thro' C, where the Plane of the Ellipſis cuts the Axis C *c* of a Cylinder, you draw the A *a*, B *b*, parallel to that Axis, 'tis plain, (from *Def.* 17.) that they will be the Sides of that Cylinder; and that the Plane A *a b* B, muſt paſs thro' its Axis. Whence you ſee, that the Line *a b*, which is the common Section of the Plane, and of the Plane of the Baſe, paſſes thro' *c* the Centre of the Baſe; and alſo, that it is cut into two equal Parts, the Line A B muſt alſo be biſected in C.

Again, the Tangents, *a f*, *b g*, which paſs thro' the Extremities of the Diameter *a b*, being parallel; the Tangent Planes, *f a* A, *c b* B, muſt be parallel alſo, and will form in the Plane of the Ellipſis, two parallel Lines, A *c*, B G, which ſhall be Tangents to that Curve in the extreme Points, A, B, of the Line A B; wherefore that Line will be a Diameter.

Which was the ſecond Point to be proved.

CONSECTARY.

Hence 'tis evident, that thro' any one Point given in the Plane of an Ellipſis, different from its Centre, there can only one Diameter be drawn.

PROP. XIV.

Every Ordinate M P N (*See* Fig. 149.) *of an Ellipſis is biſected in the Point* P, *by the Diameter* A B, *and converſly.*

If a Right-line, as M P N, terminated within an Ellipſis, and not paſſing thro' its Centre C, is biſected in the Point by a Diameter, as A B, it ſhall be true Ordinate on each Side of that Diameter.

Having drawn thro' the Points, A, B, M, N, the Sides, A *a*, B *b*, M *m*, N *n*, parallel to C *c* the Axis of the Cylinder, and interſecting the Plane of the Baſe, in the Points, *a*, *b*, *m*, *n*; the Line P *p*, which is the common Interſection of the two Planes, A *a b* B, M *m n* N, will be parallel to the Sides of the Cylinder; becauſe all thoſe Sides are parallel to one another. The Plane A *a b* B alſo muſt paſs thro' C *c* the Axis of the Cylinder, becauſe the Diameter A B paſſes thro' the Point C, where that Axis interſects the Plane of the Ellipſis, and conſequently it will form in the Plane of the Baſe a Line, as *a b*, which will paſs through the Centre *c*; *i. e.* which will be a Diameter. This being ſuppoſed:

1. Becauſe, by the Hypotheſis, the Line M P N is an entire Ordinate to the Diameter A B, it will be parallel to the Tangents, A F, B G, which paſs thro' the Ends of that Diameter; and conſequently the Tangent Planes, F A *a*, G B *b*, will be parallel to the Plane M *m n* N; wherefore the three Lines formed by thoſe three Planes, by their Interſection with the Plane of the Baſe, as *a f*, *b g*, and *m n*, muſt alſo be parallel; and conſequently the Line *m n* will be Normal to the Diameter *a b*, and therefore will be biſected by it in the Point *p*; wherefore, becauſe of the Parallels, M *n*, P *p*, N *n*, it will follow, that the Line M N muſt alſo be biſected in the Point P.

2. And then, as to the Converſe, if you draw in the Plane of the Ellipſis, the two Tangents, A F, B G, (*Cor.* 4. *Prop.* 5.) parallel to M N, and then from the Points of the Contact, the Diameter A B. 'Tis plain (from *Def.* 13, 14.) that from the Right-line M N, will be an entire Ordinate to that Diameter; and conſequently will be biſected in P, by that Diameter.

But as there can but one Diameter be drawn thro' P (by the Precedent) it will follow, that if a Line, as M N, terminated within any Ellipſe, and not paſſing thro' its Centre, be biſected in B, by a Diameter A B, it ſhall be a true entire Ordinate to that Diameter.

PROP. XV.

If in an Ellipſis there be two Diameters, AB, DE, (*See* Fig. 149.) *and one of them, as* D E, *be parallel to the Tangents,* AF, BG, *which paſs thro' the Extremities of the other,* AB.

I ſay, that the Diameter A B ſhall be parallel to the Tangents which paſs thro' the Extremities of the Diameter, D E.

Note, *In this Caſe the Diameters,* A B *and* D E, *are called* Conjugate *one to another.*

Having drawn thro' the Points, A, B, D, E, the Sides A *a*, B *b*, D *d*, and E *e*, of the Cylinder, which cuts the Plane of the Baſe in the Points, *a*, *b*, *d*, *e* ; the Planes A *a b* B, D *d e* E, will paſs thro' the Axis of the Cylinder, becauſe the Lines A B and D E are Diameters of the Ellipſis ; and conſequently they will form in the Plane of the Baſe, the two Diameters, *a b*, *d e*. But the Tangent Plane F A *a* being parallel to the Plane D *d e* E, will form in the Plane of the Baſe a Tangent, as *a f*, parallel to the Diameter *d e* ; which Diameter alſo will be Normal to the Diameter *a b*.

If then, thro' one of the Extremities *d* of the Dimeter *d e*, you draw a Tangent to the Circle, as *d h*, that will be parallel to *a b*, and the Plane *h d* D, to the Plane A *a b* B. Wherefore the common Sections of thoſe two Planes, with the Plane of the Ellipſis, *i. e.* the Tangent D H, and the Diameter A B, muſt alſo be parallel one to another.

The ſame thing may be proved with Regard to the Tangent that paſſes thro' the other End, E, or of the Diameter, D E.

Wherefore the Propoſition is proved.

CONSECTARIES.

I. From hence 'tis plain, that if there be two conjugate Diamerers in an Ellipſis, as A B, D E, the two Planes which paſs thro' thoſe Diameters, and thro' the Axis of the Cylinder, will form in the Plane of the Baſe two Diameters, *a b*, *d e*, which ſhall be normal one to another.

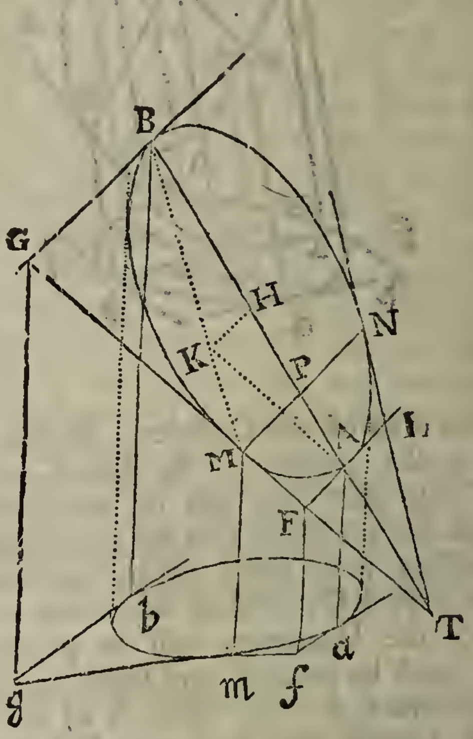
II. It follows alſo from this Propoſition, that if thro' any Point, as P, of a Diameter, as A B, in an Ellipſis, you draw an entire Ordinate, as M P N, that ſhall be parallel to the conjugate Diameter, D E, and you will have (by *Conſect. Prop.* 9.) theſe Propoſitions, $MP \times PN$, (or PM^2) : $DC \times CE$, (or CD) : : $AP \times PB$. $AC \times CB$, (or AC^2) and that will give us PM^2 $AP \times PD$: : DC^2 AC^2 : : $\frac{DC^2}{4}$ (or DE^2) $\frac{AC^2}{4}$ (or A B) : That is, the Square of any Semi-ordinate to the Diameter, that is, M P is to the Rectangle A P B under the Parts of that Diameter : : as the Square of the conjugate Diameter D E is to the Square of the Diameter A B.

PROP. XVI.

If thro' any Point, as M, *in an Ellipſis* A M B, *and Tangent* F M G, *be drawn, which in the Points* G F, *ſhall interſect any two parallel Tangents, as* A B, B G; *I ſay,* F M, M G : : A F, B G.

For, drawing thro' the Points of Contact, A, B, M, the Sides, A *a*, B *b*, M *m*, of the Cylinder; and thro' theſe Sides, and the Tangents, A F, B G, F G, drawing the Planes F A *a*, G B *b*, F M *m*, or G M *m*,

Fig. 22.



'tis plain, that F *f*, G *o*, the common Sections of the firſt two Planes with the third, muſt be both parallel one to another, and to the Sides of the Cylinder. For the two Planes, F M *m*, F A *a*, paſſing thro' the Sides, M *m*, A *a*, which are parallel, will have their common Section F *f* parallel to thoſe Sides : And for the ſame Reaſon, G *o*, the common Section of the two Planes, G B *b* and G M *m*, will be parallel to the Sides B *b*, M *m*. Moreover, the Line, *a f*, *b g*, which, from the parallel Tangent Planes, F *a*, G B *b*, with that of the Baſe being parallel : The Parts, *f m*, *m o*, of the third Tangent, formed in the Plane of the Baſe, by the third Tangent Plane, F M *m*, or G M *m*, muſt be (by the Property of the Circle) parallel to the Tangents, *a f*, *b o*, vid. *f m* parallel *f a*, and *m o* parallel *o b*.

Which being ſuppoſed, by Reaſon of the Right-lines, A *a*, F *f*, M *m*, G *o*, B *b*, and A F, B B, and *a f*, *b o*, which are reſpectively parallel to one another, you will have

F M, M G : : *f m*, or *f a*, *m o*, or *g h* : : F A, G B. *Q. E. D.*

CONSECTARIES.

I. If thro' the Points of Contact, A, B, of the two parallel Tangents, A F, B G, a Diameter, as A B, be drawn, which will interſect in the Point T, another Tangent, as F M G : And if an Ordinate, as M P, be drawn to that Diameter, 'tis plain, that A P, P B : : F M, M G : : A F, B G : : A T, B T. And alſo, that P B — A P, B P : : B T — A T, (or B A) B T.

II. From hence the following manner of drawing to the Point M, in an Ellipſis, a Tangent, as M T, is taken, when the Diameter A B is given, with the Poſition of its Ordinates.

From one of the Ends B, of the Diameter A B, to give a Point M, let the Right-line B M be drawn; and then, having drawn the Ordinate M P to the Diameter A B, and taken in that Diameter towards the Point P, a Part, as P H = P A, draw H K parallel to P M, which ſhall interſect the Line M *m* K, thro' which Point, and the other End of the Diameter A, drawing A K, and then M T parallel to it, that Line, M T, ſhall be the Parallel required.

For, on account of the Parallels, M P, H K, and A K, M T, you will have B P, D H, or P A : : B M, M K : : T B, T A.

III. If in an Ellipſis there be two Tangents, as M T, N T, which meet in the Point T.

I ſay, the Diameter A B paſſing thro' the Point P, the Middle of the Line M N, joining thoſe two Tangents in their Points of Contact, ſhall paſs alſo thro' T, their Point of Interſection.

For P N is an Ordinate to the Diameter A B, as well as P M; and conſequently (by *Cor.* 1.) the Tangents, M T, N T, muſt ſo meet or interſect the Diameter in a Point, as T, that P B — A P, P B : : A B, B T, that is, in the ſame Point.

IV. If to the Point of Contact, M, N, of two Tangents to the Ellipſis, a Right-line, as M N, be drawn; and that it have a third Tangent, as F A L parallel to it: I ſay, that F A, A L, the Parts of that third Tangent, taken between its Points of Contact A, and the two former Tangents, will be equal one to another.

For, drawing thro' the Points of Contact A, the Diameter A B, 'tis plain the Line M N will be an entire Ordinate to that Diameter, becauſe it is parallel to the vertical Tangent F L; and therefore alſo it muſt be biſected in P, and (by *Cor.* 3.) will paſs thro' T, the Point of Interſection of the two Tangents, M F, N L; or will be parallel to them (by *Prop.* 15.) when the Line M N is a Diameter.

But 'tis plain in both Caſes, that F L will be biſected in A, by the Diameter A B; becauſe M N is ſo biſected in the Point P, by the ſame Diameter.

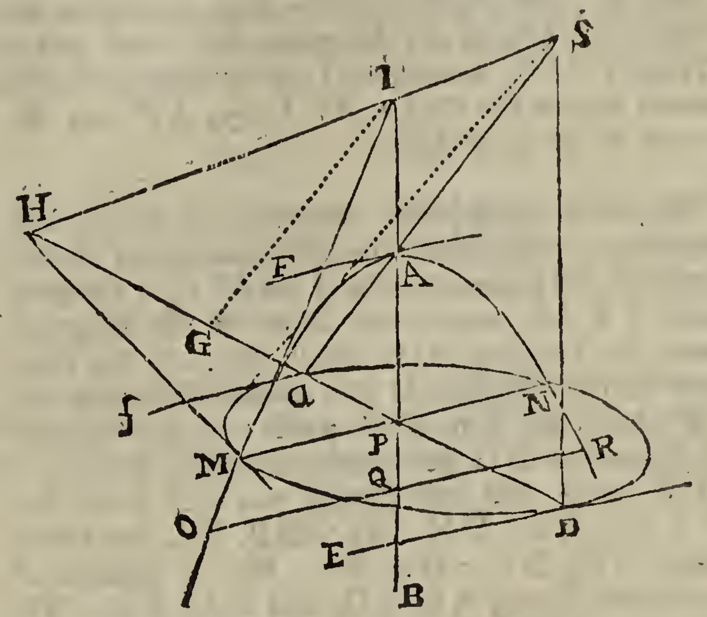
Of the Parabola *and* Hyperbola *particularly.*

PROP. XVII.

In the Parabola, *every entire Ordinate, as* M P N, *to a Diameter, as* A B, *is biſected by that Diameter in the Point* P, *and* vice verſa.

For having made an Elliptick Plane, which ſhall paſs thro' the Line M N, that will form with the Tangent Plane S D E, parallel to the parabolick Plane, a Tangent, as D E, parallel to M N.

Fig: 23:



Again, the Plane S A F, drawn thro' S the Vertex of the Cone, and thro' the Tangent A F, which paſſes thro' A, the Vertex of the Diameter A B, will form in the Elliptick Plane, a Tangent, as *f a*, and the Line D *a*, jointly, the Points of Contact of the two Tangents, D E, *a f*, will paſs through the Point P, becauſe the Diameter A B is parallel to the Tangent Side S D.

This ſuppoſed,

Becauſe by the Hypotheſis A F and M N, are parallel, (vid. *Def.* 14.) it will follow, that the Tangent *a f*, which is the common Section of two Planes paſſing thro' thoſe Lines, will be parallel to M N, and conſequently to D E. Whence it appears, that the Line D *a* (by *Def.* 13.) joining the Points of Contact of the two parallel Tangents, D E, *af*, is a Diameter of the Ellipſis; and alſo, that the Line M N, which is parallel to thoſe Tangents, and terminated by the Ellipſis, ſhall be (by *Prop.* 14.) biſected in the Point P.

The *Converſe* will thus appear:

Draw, in the parabolick Plane, the Tangent A F, (by *Cor.* 4. of *Prop.* 5.) parallel to the Line M N; and thro' the Point and Contact A, a Diameter, as A B, the Line M N will be an Ordinate rightly apply'd (by *Def.* 14.) and conſequently muſt be biſected in P.

And becauſe there is but one only Diameter that can paſs thro' that Middle-point P, A B muſt be it, (by *Def.* 15.) and in the following Corollary.

CONSECTARY.

Hence 'tis evident, that if thro' any two Points, P, Q, of a Diameter A B, two entire Ordinates, M P N, O Q R, be drawn, you will always have this Proportion, (by *Conſect.* *Prop.* X.) that $MP \times PN$, or PM^2, $OQ \times QR$ (or OQ^2) : : A P, A Q; that is, the Square of any two Ordinates, as of M P, Q O, to any Diameter, as A B, are always as the *Abciſſæ* or intercepted Parts of that Diameter, A P, A Q.

PROP. XVIII.

(See *Fig.* 23.)

If thro' M*, any Point in a Parabola, you draw an Ordinate* M P*, to any Diameter* A B*; and alſo a Tangent* M P*, meeting in* T*, that Diameter produced beyond the Vertex* A*: I ſay,* A P *will always be equal to* A T.

The ſame thing being ſuppoſed, as in the laſt Propoſition: Let there be alſo drawn thro' S, the Vertex of the Cone, and the Line M T, a Tangent Plane, S T M, which will form in the Elliptick Plane, the Tangent M H, which will cut the Diameter of the Ellipſis *u* D in a certain Point, as H, thro' which the Line S U paſſes: And laſtly, let the Right-line T G be drawn parallel to S A.

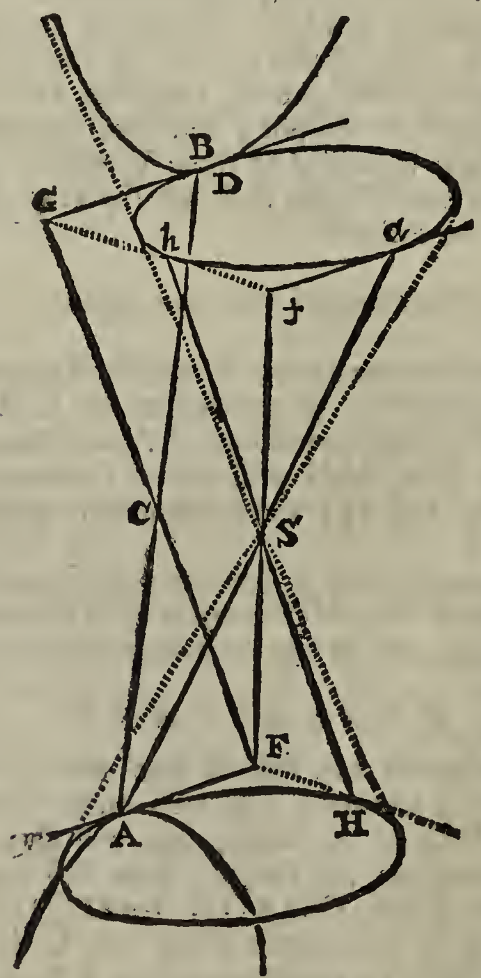
This being well underſtood, you will have (by *Cor* 1. *Prop.* 16.) D H, H *a* : : D P, P *a*, and alternately, D H, D P : : H *a*, P *a*. But by Reaſon of the parallel Lines, A B, S D, and S A, T G: 'Tis plain, that D H D P : : S H S T : : H *a* G *a*; wherefore H *a*, P *a* : : H *a*, G *a*; and conſequently P *a* = G *a*; and therefore A P = A T. *Q. E. D.*

PROP. XIX,

In the oppoſite Hyperbola's, every Diameter, as A B*, paſſeth thro'* C*, the Point of Interſection of the Aſſymptotes, and is there cut into two equal Parts, and,* vice verſa*, that Point is called the Centre.*

Let H S *h* be one of the two common Sections of a Plane parallel to the Hyperbolick Plane, and the two oppoſite Conick Surfaces, and let the Aſſymptote F G be formed by the Interſection of the Plane of the Hyperbola, with that which touches the two Surfaces H S *h*.

Fig. 24.



Let there be drawn thro' the parallel Tangents, A F, B G, which paſs thro' the Ends of the Diameter A B, and interſect the Aſſymptote F G, in the Points, F, G, two parallel Elliptick Planes; and thoſe will form with the Tangent Plane which paſſes thro' the Side H S *h*, the parallel Tangents, F H and G *h f*; and in the Tangent Plane S A F, the parallel Tangents, A *f*, *a f*.

This Proportion being made, the parallel Lines, F H, G *h*, being contained between the two other Parallels, F G, H *h*, will be equal. And the ſimilar Triangles, S H *f*, S *h f*, and S F A, S *f a*, will give H F, *h f* : : S *f*, *s f* : : F A, *f a*; and alſo, H F, F A : : *h f*, *f a* : : (by *Prop.* 16.) to G G B. And hence, becauſe H F, H G, it will follow, that A F = B G, and becauſe of the ſimilar Triangles, A C F, B C G, it will follow, that A C = C B; that is, the Aſſymptote F G, biſects the Diameter A B in C.

The ſame thing may be proved of the other Aſſymptote, that it ſhall paſs alſo thro' C, the Middle of the Diameter A B; from whence 'tis apparent, that the Diameter A B paſſes thro' C the Centre of the two Aſſymptotes, and is there biſected.

Let there be then a Line, as A B, which paſſing thro' C the Interſection of the Aſſymptotes, ſhall interſect the oppoſite Hyperbola's in the Points A B. If then you draw thro' the Point A, the Tangent A F, and to the oppoſite Hyperbola, a Tangent D G, (by *Conſect.* 4. *Prop.* 5.) parallel to A F; 'tis plain, that ſince the Line A D may be proved to be a Diameter, it will paſs thro' C, the Point of the Interſection of the Aſſymptotes. It muſt be coincident then with A B, which (by the Hypotheſis) paſſes thro' the ſame two Points, A C; wherefore the Line A B is a Diameter, and is biſected in C.

CONSECTARY.

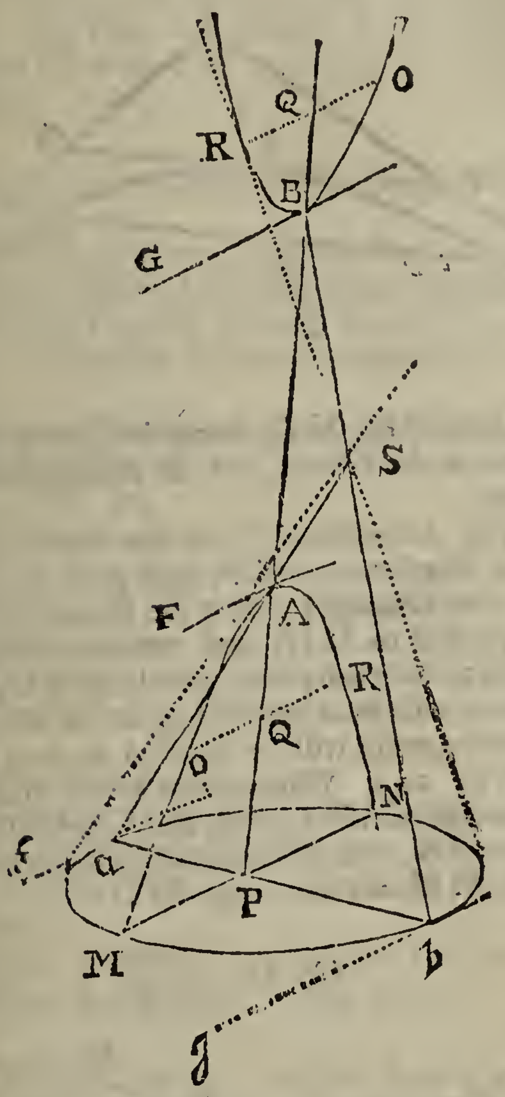
Hence you ſee, that from any Point given within an Hyperbola, there can be but one only Diameter drawn; becauſe no other Line can paſs thro' that Point, and thro' the Centre.

PROP. XX.

In the oppoſite Hyperbola's, every entire Ordinate M P N*, is biſected in* P*, by its proper Diameter* A B*; and* vice verſa.

Having made an Ellíptick Plane to paſs thro' the Line MN, it will form in the two Tangent Planes SAF, SBG^2, the Tangents af, bo. And the Line ab connecting the Points of Contact of thoſe two Tangents, being the common Section of the Elliptick Plane of the Plane SAB, will paſs thro' the Point P.

Fig. 25.



But becauſe by the Hypotheſis, the two Lines AF, MN are parallel, it follows, that the Line af, which is the common Section of two Planes paſſing through theſe two Lines, will be parallel to MN.

For the ſame Reaſon, the Tangent bg, which is the common Section of the Elliptick Plane, and of the Tangent Plane SBG, which two Planes do paſs thro' the two Parallels MN, BG, will be parallel to MN.

The Tangents then, af, bg, will be parallel one to another; from whence it will follow, that the Line ab (by *Def.* 13.) is a Diameter of the Ellipſis; and alſo that the Line MN (by *Prop.* 14.) is biſected in the Point P.

And to prove the *Converſe*;

Draw in the Plane of the Hyperbola two Tangents, as AF, BG, (by *Cor.* 4. of *Prop.* 5.) parallel to the Line MN, terminated within the Hyperbola: And then, having drawn through their Points of Contact, the Diameter; 'tis plain (from *Def.* 14.) that the Diameter will have the Line MN an entire Ordinate rightly apply'd, and that it ſhall biſect it in P. But as there can be but one Diameter paſs thro' that Point, (by *Cor.* of *Prop.* 20.) it will follow, that if a Line, as MN, terminated in P by a Diameter AB; it muſt be an entire Ordinate, and rightly applied in that Point.

CONSECTARY.

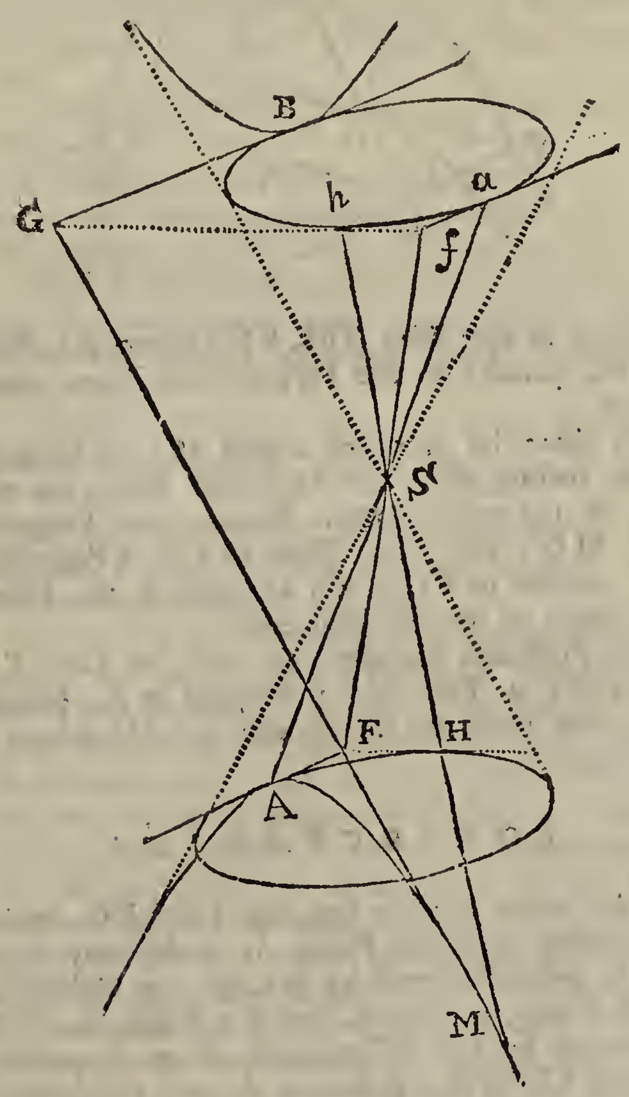
Hence 'tis apparent, that if you rightly apply two entire Ordinates MPN, and OQR, to one and the ſame Diameter, it will always be (by *Conſect. Prop.* 9.) $MP \times PN$, (or PM^2) $OQ \times QR$ (or OQ^2) :: $AP \times PB$, $AQ \times QB$.

PROP. XXI.

If thro' any Point M *in an Hyperbola, a Tangent* MFG *be drawn, interſecting two other parallel Tangents,* AF, BG, *in the Points* FG; *I ſay, that* MF, MG :: AF, BG.

Drawing two elliptick and parallel Planes, which ſhall paſs thro' the Tangents AF, BG, they will form in this Tangent Plane SMG, two Tangents HF, hG, which will be parallel; and the Elliptick Plane paſſing thro' BG, will form in the Tangent Plane SAF, a Tangent af, which will interſect the Tangent hg in the Point f, where the Line SF cuts the Elliptick Plane.

Fig. 26.



This being laid down or ſuppoſed, the Tangents af, BG, will be parallel, becauſe each is ſo to the Tangent AF. And therefore (by *Conſect.* from *Def.* 15.) you will have BG, Gh :: af, fh, (and becauſe of the ſimilar Triangles Shf, SHF, and Saf, SAF) :: AF, FH: Wherefore BG, AF :: Gh, FH (*i. e.* becauſe of the ſimilar Triangles MGH, MFH) :: MG, FG. *Q. E. D.*

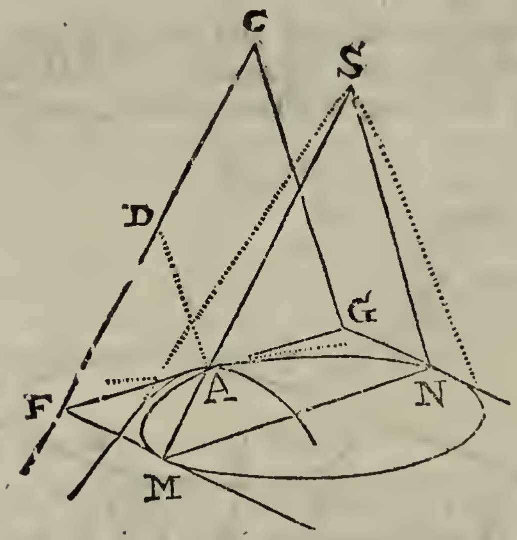
N. B. 'Tis evident, that from this *Prop.* the ſame Corollaries may be drawn, as are in the Ellipſis (from *Prop.* 16.) and therefore there is no need to expoſe them at Length here.

PROP. XXII.

If a Right-line F G, *terminated between the Aſſymptotes of an Hyperbola, touch the Curve in a Point at* A, *it will always be biſected in that Point.*

Let there be drawn thro' S, the Vertex of the Cone, and thro' the two Aſſymptotes CF, CG, two Planes touching the Conick Surface. (See *Def.* 16.) in the Sides SM, SN, where the Plane MSN, parallel to the Hyperbolick Plane, interſects it.

Fig. 27.



Let there be ſuppoſed drawn alſo an Elliptick Plane, paſſing thro' the Right-line FG; this will form in the two Tangent Planes, two Tangents, MF, MG; and in the Plane MSN, a Right-line MN parallel to FG; and connecting the Points of Contact of the two Tangents.

This ſuppoſed, 'tis apparent, that the Line FG (by *Conſect.* 4. *Prop.* 16.) is biſected in A; becauſe it touches both the Ellipſis and the Hyperbola in that Point.

CONSECTARIES.

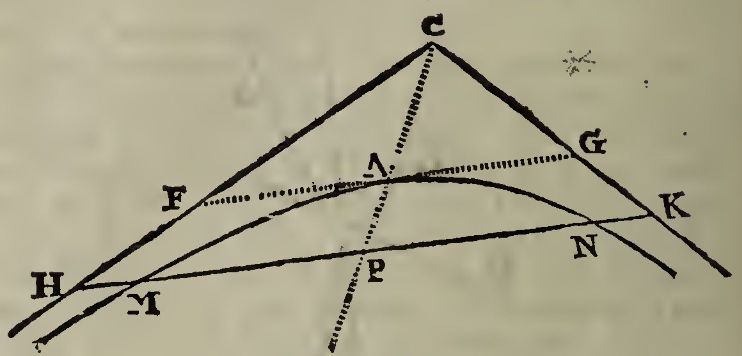
I. As there can be but one Line FG, which paſſing thro' a given Point A, within any Angle FCG, and terminated by its Legs, can be biſected in that Point; it follows, that if a Right-line FG, terminated by the Aſſymptotes of an Hyperbola, meet the Curve in a Point, as A, and be there biſected, it will be a Tangent to the Hyperbola in that Point.

II. Hence 'tis evident, that to draw thro' a Point given, as A, in an Hyperbola, whoſe Aſſymptotes CF, CG are given, a Tangent, as FAG; you need only draw AD parallel to one of the Aſſymptotes CG, and terminated by the other; and haveing then taken DF = to CD, draw the Line FAG, for that ſhall be the Tangent required.

For, by Reaſon of the ſimilar Triangles FCG, and FDA, the Line FG muſt be biſected in A, becauſe CF (by the Conſtruction) is ſo in D.

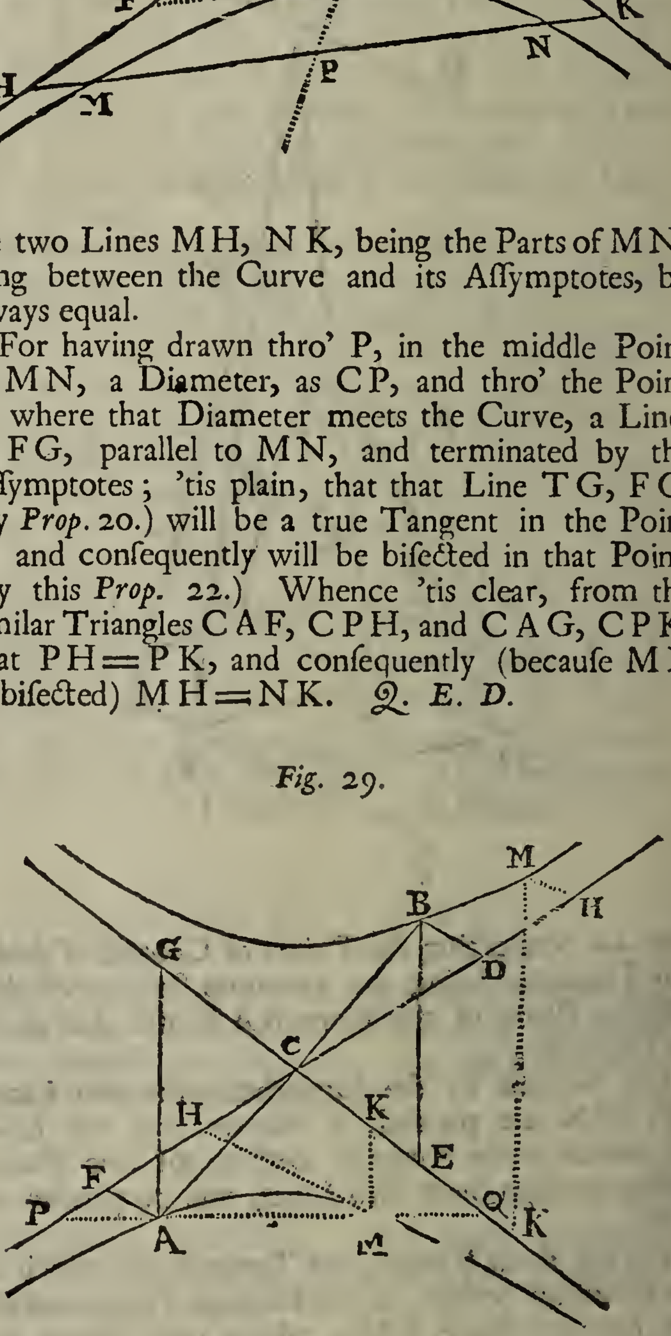
III. If any two Points MN, within an Hyperbola, be joined by a Right-line, as MN, interſecting the Aſſymptotes in the Points HK; then will the two Lines MH, NK, being the Parts of MN, lying between the Curve and its Aſſymptotes, be always equal.

Fig. 28.



For having drawn thro' P, in the middle Point of MN, a Diameter, as CP, and thro' the Point A, where that Diameter meets the Curve, a Line, as FG, parallel to MN, and terminated by the Aſſymptotes; 'tis plain, that that Line TG, FG, (by *Prop.* 20.) will be a true Tangent in the Point A, and conſequently will be biſected in that Point. (by this *Prop.* 22.) Whence 'tis clear, from the ſimilar Triangles CAF, CPH, and CAG, CPK, that PH = PK, and conſequently (becauſe MN is biſected) MH = NK. *Q. E. D.*

Fig. 29.



IV. If thro' any Point, as A, in an Hyperbola, two Right-lines, AF, AG, be drawn, and terminated by its Aſſymptotes; and if from any other Point, as M, in the ſaid Hyperbola, or its Oppoſite, you draw two other Right-lines MH, MK, terminated alſo by its Aſſymptotes, and parallel to the two former AF, AG:

I ſay, the Rectangle FAG, will always be equal to the Rectangle HMK. For,

1. When the Points AM fall in one and the ſame Hyperbola, having drawn a Right-line, joining the two Points A, M, and cutting the Aſſymptotes in P and Q; the ſimilar Triangles PAF, PMH, and QMK, QAG, will give theſe Proportions; AF, MH : : AP, MP, (by *Cor.* 3.) : : MQ : AQ : : MK : AG; and then multiplying the Extremes and Means, you have FA × AG = HM × MK.

2. When the Points A, M, fall in the two oppoſite Hyperbola's, having drawn thro' the given Point A, and the Centre C, the Diameter AB,

and alſo the two Right-lines BD, BE, parallel to AF, AG, and terminated by the ſame Aſſymptotes; 'tis evident, that the Triangles CAF, CBD, and CAG, CBE, being not only ſimilar, but alſo reſpectively equal one to another, becauſe $CA = CB$ (by *Prop.* 19.). Therefore $BD = AF$, and $BE = AG$, and conſequently $BD \times BE = FA \times AG$. But from the former Caſe, $KM \times MH = DB \times BE$; wherefore now alſo $FA \times AG = KM \times HM$.

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CONICK *Surface.* Let the Side of a right Cone be called a, the Radius of its Baſe r: Then by what is proved under the Word Pyramid, the Area of the Convex Surface of the Cone is $= \frac{1}{2}$ the Periphery of the Baſe multiplied into the Side of the Cone: That is, Since $2r =$ to the Diameter, and $2re =$ to the Periphery, it will be expreſſed by rea. And from hence it will be eaſy to deduce that noble Propoſition of *Archimedes: That a Circle, whoſe Area is equal to the Convex Surface of the Cone, will have its Radius a mean Proportional between the Side of the Cone and the Radius of the Baſe.* For ſince $\surd : ar$ is ſuch a mean Proportional between a and r; if you ſuppoſe that to be the Radius of the Circle required, its Diameter will be $2 \surd : ra$ and its Periphery $2 \surd rae$; and by multiplying the Periphery $2 \surd : rea$ into $\frac{1}{2} \surd ra$, the half Radius, the Area will be rea, the very ſame with that of the Surface of the Cone. *Q. E. D.*

The Surface of a right Cone may be eaſily had, by having the Radius of the Circle of the Baſe; for as that Radius is to its Periphery, ſo will the Radii of the other Circles up to the Vertex be to their reſpective Peripheries. But all thoſe Radii are the Elements of a Right-angle Triangle, whoſe Altitude and Baſe are given, and conſequently its Area is known: Wherefore as any one Radius to its Periphery, ſo will the Area of the Triangle, which is the Sum of all, be to the Sum or Aggregate of all the Peripheries, *i. e.* to the whole Conick Surface, which therefore will be known.

Conick Surface, is the Convex Surface of a Cone without its Baſe, and this is formed by the Motion of a Right-line fixed in a Point above and below, moved round the Periphery of a Circle.

CONIFEROUS *Plants*, whether Trees, Shrubs, or Herbs, are ſuch as bear a ſquamoſe, ſcaly Fruit, of a woody Subſtance, and of a Kind of Conical Figure, in which Cone are many Seeds, and when they are ripe, the ſeveral Cells or Partitions in the Cone gape or open, and the Seed drops out: Of this Kind are the *Scotch* Firrs, Male and Female, and the Pine, which in our Gardens is called the *Scotch Firr*, the common Alder, and the Beech Tree.

CONJUGATE *Diameters*, in reſpect of one another in the Ellipſis, are ſuch as are parallel to Tangents meeting the Curve in each others Vertexes.

CONJUGATE *Sections.* See *Sectiones ſequentes.*

CONJUGATE *of the Hyperbola*, is a Line drawn parallel to the Ordinates, and thro' the Centre or middle Point of the Tranſverſe Axis; and is always a middle Proportion between the Parameter (or *Latus Rectum*) and the *Latus Tranſverſum.* This Line alſo is ſometimes called the *Second Axis or Diameter.*

CONJUGATION of a Verb, [in *Grammar*] is varying or forming it by Mood, Tenſe, and Perſon.

CONJUNCTIVA *Tunica*, the ſame with *Adnata. L.*

CONJUNCTION [in *Aſtronomy*] is the meeting of the Stars or Planets in the ſame Degree of the Zodiack; and is either *Apparent* or *True. L.*

CONJUNCTION *Apparent*, is when the Right-line, that is ſuppoſed to be drawn thro' the Centres of the two Planets, does not paſs thro' the Centre of the Earth.

CONJUNCTION *True*, is when that Right-line being prolonged, paſſes alſo thro' the Centre of the Earth.

CONJUNCTION [in *Grammar*] is an undeclinable Word, which is uſed to connect or join Words and Sentences together.

CONNIVENTES *Glandulæ*, are thoſe Wrinkles which are found in the Inſide of the *Inteſtinum Ileum* and *Jejunum.* For the inner Tunick of the Guts being longer than the Middle or the Outward, it doth frequently, and in many Places wrinkle or bag out, by which Means the Paſſages for the Contents become ſtraitened, and conſequently the Matter deſcends thro' the Guts more ſlowly, ſo that the Lacteals have the more Time to imbibe Chyle. *L.*

CONOID, [of *κῶνος* and *εἶδος*, *Gr.* Form] is a Solid Body reſembling a Cone, except in this, that inſtead of a perfect Circle for its Baſe, it has an Ellipſis, or ſome other Curve approaching thereto, produced by the Circumvolution of any Section of the Cone about its Ax, and may be either a

CONOID *Elliptical*, when made by an *Ellipſis*, and then is more commonly called a *Spheroid*; and if the Revolution be made round the *Latus Tranſverſum*, it forms an oblong Spheroid; but if round the Conjugate Axis, a prolate or oblate one: Such is the Figure of our Globe, and of the other Planets.

CONOID *Hyperbolical*, when made by an *Hyperbola.*

CONOID *Parabolical*, when it is produced by the Section called a Parabola turning about its Ax.

CONOIDES. See *Conarium.*

CONSCRIBED. See *Circumſcribed.*

CONSECTARY, is a Deduction or a Conſequence drawn from a preceding Propoſition, and is the ſame with *Corollary.*

CONSENT [in *Medicine*] is the depending of one Diſtemper upon another: Thus a Difficulty of

Breathing is ſaid to proceed by Conſent from a Pleuriſy, and in that Caſe does not require a particular Cure, becauſe it ceaſes as ſoon as the Diſeaſe on which it depends is removed: Or the mutual Sympathy or Correſpondency betwixt the Parts of the Body, which is uſually ſaid to be occaſioned, 1. By the Likeneſs or Similitude of their Kind, as when one Nerve is affected with the Hurt of another. 2. By the Similitude of their Office or Function, as when the Intercoſtal Muſcles ſuffer by an Inflammation of the Diaphragm. 3. By a Communication of Veſſels, for which Reaſon a Fit of the Stone in the Kidnies is frequently attended with Vomiting. 4. By the Contiguity or Neighbourhood of the Parts, as when the Inflammation of the Pleura is communicated to the Lungs: But the two former may be reduced to the two latter, which are the only real Cauſes of a Conſent or Sympathy betwixt the Parts of the Body.

CONSEQUENCE, or *Conſequentia*, a Term in Aſtronomy. See *Antecedence.*

CONSEQUENT [in *Mathematicks*] is the latter of two Terms of Proportion, as if the Proportion were of A to B, B is ſaid to be the *Conſequent.*

CONSERVA, a *Conſerve*, is a Compoſition of Flowers or Herbs beat together, to every Pound whereof, if they be dry, are added three Pounds of Sugar; if moiſter, two Pounds, ſo that they may be kept ſeveral Years. *Blanchard.*

CONSISTENT *Bodies*; ſo Mr. *Boyle* calls ſuch as we uſually ſtile ſolid or firm ones, and he means ſuch whoſe Parts are firmly and conſiſtently united together, ſo that they do not ſlide over one another's Surfaces, as eaſily as the Parts of fluid Bodies do.

CONSOLE, is a Kind of Bracket or Shouldering-piece in Building, which hath a Projecture, and ſerves to ſupport a Cornice, or to bear up Figures, Buſts, Veſſels, and other Ornaments of the like Nature.

CONSOLIDATING *Remedies*, are thoſe Things, which cleanſing with a moderate Heat and Force, by taking Corruption out of Wounds, and preſerving the Temperature of the Parts, cauſe the Nouriſhment to be fitly applied to the Part afflicted. *Blanchard.*

CONSOLIDATION, is a Word uſed by Phyſicians and Surgeons, for the uniting ſtrongly together the Fractures of broken Bones, or the Lips of a Wound; then they ſay the Parts begin to conſolidate or join together in one entire Piece, as they were before the Fracture, or the Solution of Continuity.

CONSOLIDATION, [in *Law*] the combining and uniting of two Benefices into one.

CONSONANCE [in *Muſick*] is the Agreement of two Sounds, the one Grave, the other Acute, which are compounded together by ſuch a Proportion of each, as ſhall prove agreeable to the Ear. A Uniſon is the Firſt Conſonance, an Eighth is the Second, the Fifth is the Third, and then follows the Fourth, and the Thirds and Sixths, major and minor. There are other Conſonances, which are the Doubles or other Repetitions of the former. There can be but ſeven or eight ſimple Conſonances; the perfect ones are the Uniſon, the Eighth and the Fifth, with their Correſpondents.

CONSPIRATIONE, is a Writ that lies againſt Conſpirators. *L.*

CONSPIRING *Powers* [in *Mathematicks*] are all ſuch Powers as act in Directions not oppoſite to one another.

CONSTABLE, is a Word variouſly uſed in our Common Law: Firſt, for the Conſtable of *England*, who is alſo called *Marſhal*; his Office conſiſteth in the Care of the common Peace of the Land, in Deeds of Arms and Matters of War. The Court of the Conſtable and Marſhal determineth Contracts touching Deeds of Arms out of the Realm, and handling Things concerning War within the Realm, as Combats, Blazons of Armory, *&c.* but he may not deal with Battle in Appeals, nor, generally, with any other Thing that may be tried by the Laws of the Land. Out of his Magiſtracy were drawn theſe lower Conſtables which we call *Conſtables of Hundreds* and *Franchiſes*, and were firſt ordained by the Statute of *Wincheſter*, which appointed, for the Conſervation of Peace and View of Armour, two Conſtables in every Hundred and Franchiſe: And theſe be now *High Conſtables*, becauſe Continuance of Time, and Increaſe of People and Offences, hath again, under theſe, made others in every Town, called *Petit Conſtables*, which are in like Nature, but of inferior Authority to the other. Beſides theſe, there be Officers of particular Places called by this Name, as *Conſtable of the* Tower, *Conſtable of the Exchequer*, *Conſtable of* Dover *Caſtle*, *&c.*

CONSTAT, is a Sort of Certificate made by the Clerk of the Pipe and Auditors of the *Exchequer*, at the Requeſt of any Perſon who intends to plead in that Court for the Diſcharge of any thing. *L.*

CONSTELLATION, or *Aſteriſm*, is a Company of fixed Stars, imagined to repreſent the Image of ſomething, and commonly called by the Name of that Thing: There are 21 Northern and 12 Southern ones. *L.*

CONSTIPATION, is when the Parts of any Body acquire a cloſer Texture than what they had before. *L.*

CONSTIPATION, [in *Medicine*] a Hardneſs of the *Alvus*, or Belly, with a Difficulty of diſcharging the ſame.

CONSTITUENT Particles of any natural Body, are thoſe ſmall Particles of which it is compoſed. See *Particles.*

CONSTITUM, [in the *Civil Law*] is a Promiſe for a Debt upon a Nude Covenant, without Stipulation.

CONSTITUTIONES *Baſilici.* See *Baſilick Conſtitutions.*

CONSTRICTION, is the crouding the Parts of any Body cloſe together, in order to Condenſation. *L.*

CONSTRICTOR *Labiorum*, *Sphincter & Orbicularis Labiorum*, a Muſcle which environs the Lips with Orbicular Fibres, and when it acts it purſes them up; wherefore ſome name it *Oſculatorius.* *L.*

CONSTRICTORES *Alarum Naſi ac Depreſſores Labii Superioris*: Theſe Muſcles ariſe from the fourth Bone of the upper Jaw, immediately above the Gums of the *Dentes Inciſorii*, and aſcending, are ſoon inſerted to the Roots of the *Alæ Naſi*, and ſuperior Parts of the upper Lip; they draw the upper Lip and *Alæ* downwards. *L.*

CONSTRUCTION, [in *Geometry*] the Art or Manner of drawing or deſcribing a Figure, Scheme, the Lines of a Problem, or the like.

CONSTRUCTION *of Equation*, an eaſy way of conſtructing Cubic and Biquadratic Equations, without the Parabola, communicated by the ingenious *J. P.* M A.

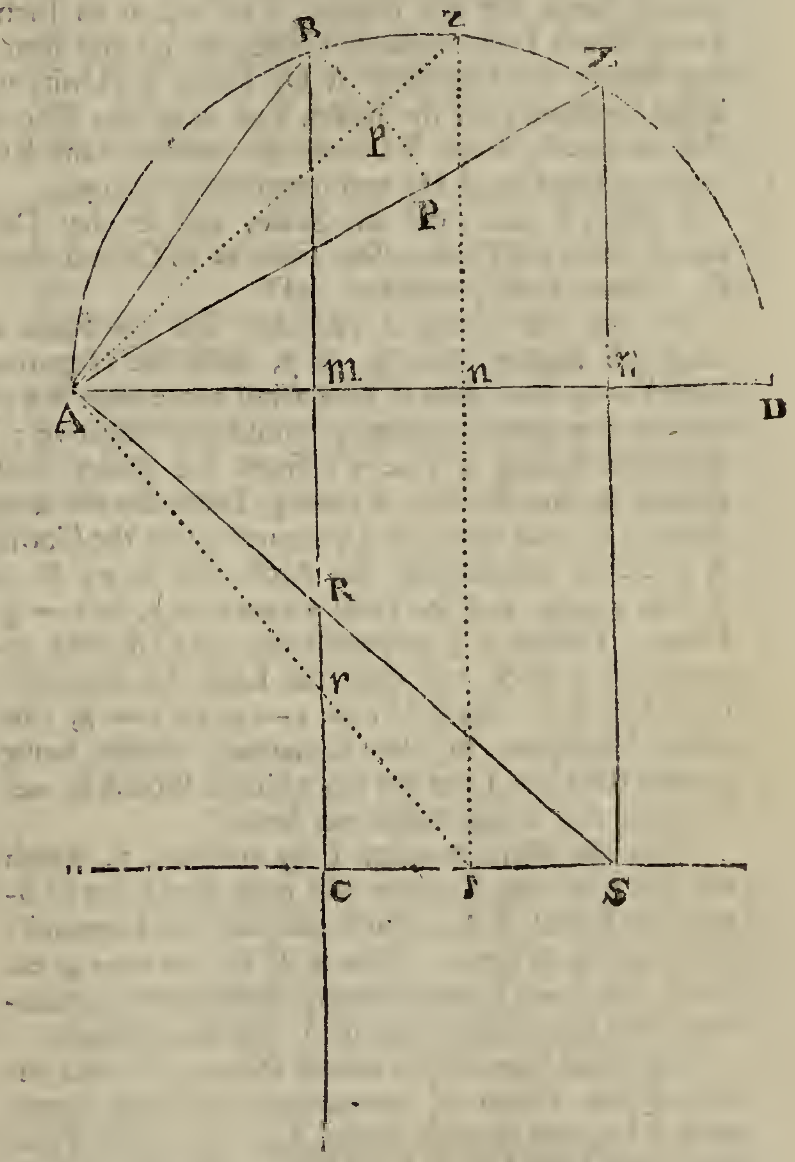
In order to this Method of Conſtruction, I conſider each Side of the Equation as the Product of two Multipliers, the one of two Dimenſions, the other of one, (each Term in a Cubic Equation being ſuppoſed of three Dimenſions). *E. G.* In this Equation $x\,x\,x + p\,x\,x = n$; I conſider it as in this Form, $x\,x \times \overline{x + p} = n = b^2 \times c$, ($b$ being taken at Pleaſure for any Number whoſe Square is leſs than n divided by $b\,b$ gives c). Or elſe in this Form, $\overline{x\,x + p\,x} \times x = n = b^2 \times c$; either of which Forms may be made uſe of, as ſeems leſs for Conſtruction. And becauſe x is yet unknown, and muſt be taken by Gueſs, I put z inſtead of x the Multiplier of two Dimenſions, and y for x in the other of one Dimenſion; and then the former Equation will ſtand thus, $z\,z \times \overline{y + p} = b^2 \times c$; or (the other way) $\overline{z\,z + p\,z} \times y = b^2 \times c$. In both which Forms, the given Quantity $b^2 \times c = n$, is the ſame as in the firſt Equation, and conſequently the Reſult or Value of the other Terms is the ſame alſo.

The Deſign then of this Method is, by taking a Number or Line by Gueſs (ſuppoſe z) to repreſent x in one of the Multipliers of the given Equation, to find another Number or Line (y) which ſhall repreſent x in the other Multiplier; and then, if z and y be not equal, to bring them by Trials to Equality, which in moſt Caſes is eaſily done, obſerving their Difference, and the Nature of the Scheme or Figure.

Before I give Examples, I will premiſe this Lemma, which ſhews the Ground and Demonſtration of this way of Conſtruction.

Let A B D be a Semicircle on the Diameter A D; A B and A Z, two Subtenſes drawn at Pleaſure from the End of the Diameter A; from B and Z are drawn the infinite Lines, B C and Z S, perpendicular to A D, B C interſecting it in m, and Z S in n; from A draw the Line A S interſecting B C in R, and Z S in S; I ſay, that A B q : A Z q : : m R : N S.

Fig. 1.



For (by the Nature of a Circle) D A × m A = A B q, and D A × n A = A Z q; then D A × m A : D A × n A : : m A : n A : : m R : n S; that is, A B q : A Z q : : m R : n S.

Multiply the extreme and middle Terms, and 'tis A B q × n S = A Z q × n R; if therefore we ſuppoſe A B = b, n S = c, A Z = to the Square-Root of the Multiplier of two Dimenſions (in a Cubick Equation reduc'd into the Form above directed) then will m R be = to the other Multiplier of one Diviſion. So in the firſt Form above, ($z\,z \times \overline{y + p} = b^2 \times c$) if A Z = z, then is m R = $y + p$; and in the ſecond Form, $\overline{z\,z + p\,z} \times y = b^2 \times c$, if A Z = $\sqrt{z\,z + p\,z}$, then is m R = y; and if $y = z$, then $z = x$ in the given Equation.

Example I.

Suppoſe I would conſtruct this Cubick Equation, $x\,x\,x - 4\,x\,x = 72$, or $x\,x\,x - p\,x\,x = n$, I take 16, as a convenient ſquare Number, (which I call $b\,b$) and therewith I divide 72, the Quotient is $4\frac{1}{2}$, which I call c, [$\frac{n}{bb} = c$, and $bbc = n = 72$] I deduce alſo the other Side of the Equation into two Multipliers (as above) and then 'tis $zz \times \overline{4 - p} = 72 = 16 \times 4\frac{1}{2}$, which is the firſt Form of Conſtruction.

I deſcribe a Semicircle A B D (See *Fig.* 1.) of a convenient Bigneſs for my Scale of equal Parts, (which here, for this Figure, is of 24 in an Inch, 10 of which Parts make an Unite, or 1.) and haveing drawn the Diameter A D, I take 4 (Units or large Diviſions) off the Scale, and draw the Chord $AB = 4 = b$; from B I draw the infinite Line B C perpendicular to A D, and interſecting it in m.

I take $4\frac{1}{2}$ ($= c$) off the Scale, and ſet that Diſtance, with the Compaſſes, from m to C, and thro' C, I draw C S, parallel to A D.

For the firſt Trial, I conſider that the Root x muſt be bigger than 4, or p, (elſe the Negative Term $- 4xx$, wou'd take away more than xxx, and ſo the given Quantity would be Negative ;) therefore taking 4 ($= p$) from the Scale, with Centre A, and Radius $Ap = 4$, I deſcribe the little Arch Pp; and then (at a Venture) draw the Chord Az ($= z$) interſecting the Arch Pp in p; ſo is $Ap = p = 4$, and the Line $pz = z = p$, or $z - 4$. From z I draw Z S perpendicular to C S, and interſecting it in S, and then the Line A S interſecting M C in r. So is $Mr = y - 4$, or $y - p$, (the other Multiplier in the Equation) which being greater than the Line pz (to which it ſhould be $=$) it ſhews that z was taken too little.

After the ſame manner I try another, z, which the View of the Scheme will now direct me to limit, till I find A Z, which anſwers the Demand : For making $AZ = z$, then is P Z ($= z - 4$) $=$ M R ($= y - 4$) conſequently $Z = y = x$, z takeing from the Scale, is $=$ to 6, the Root ſought.

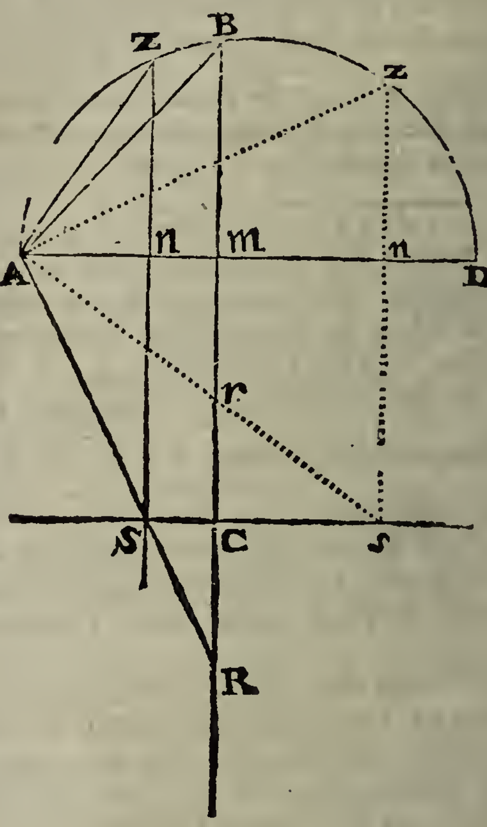
The ſame Concluſion would follow, if I had inverted the Order of proceeding, and had begun with Mr, and thereby found Az (in a firſt Trial) for in this Caſe I muſt have taken a Line for y (by Gueſs) and made $mr = y - p$; and then having drawn A S interſecting mC in r, and C S in S. Alſo S Z parallel to B C, touching the Semicircle in z, I draw Az, which will be equal to z ; ſo is the Line $pz = z - p$, which ought to be equal to mr; but not being ſo, another Trial muſt be made.

Example II.

Suppoſe I would find the Root of this Equation, $xxx - 3xx + 2x = 24$, or $xxx - p\,2x + qqx = n$. I take for bb, 9, by which dividing 24, it gives $C = 2\frac{2}{3}$, and then I put the Equation into this Form, $\overline{zz - pz + qq} \times y - bb \times C$.

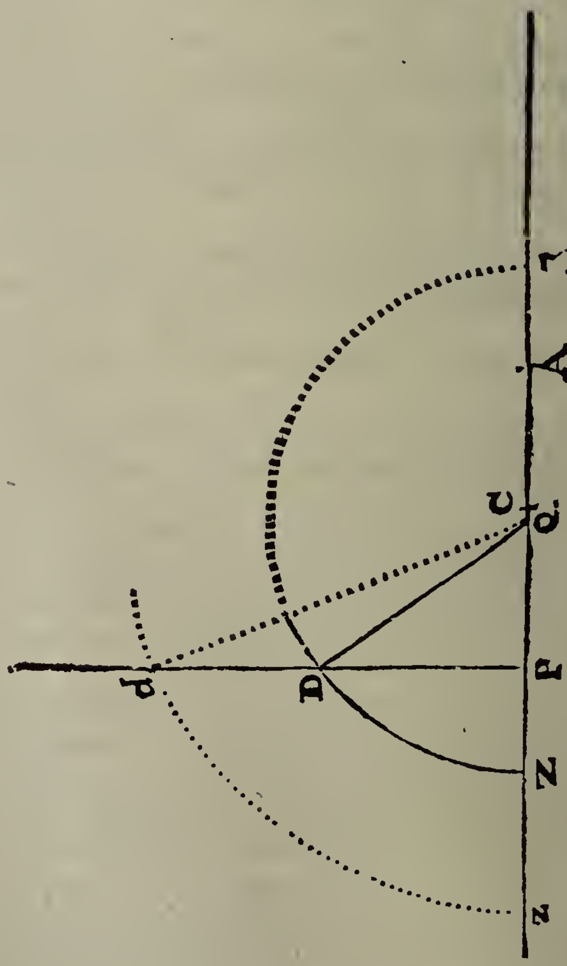
In the Semicircle A B D, I draw the Chord $AB = b = 3$. B C perpendicular to A D. $mC = C = 2\frac{2}{3}$. CS parallel to A D.

Fig. 2.



I find $\sqrt{zz - pz + qq}$, by *Fig.* 3, where $AP = p = 3$, and is biſected in C. $PQ = q = \sqrt{2} = 14$. P d is perpendicular to P A, A z, A Z,

Fig. 3.



&c. are Lines taken by Gueſs for z. zd, Z D, *&c.* are Arches of Circles drawn with Centre C, and Radius C z, C Z, *&c.* So are P d, P D, *&c.* $= \sqrt{zz}$

$\sqrt{\overline{zz-pz}}$, and dQ, DQ, &c. $=\sqrt{\overline{zz-pz+qq}}$ For continuing the Arch Z D (for Inſtance) to ζ in the Diameter; $ZA\ (=P\zeta)=z$. $PZ=z-p$. Therefore $PD\ (=\sqrt{\overline{P\zeta\times PZ}})=\sqrt{\overline{z\times z-p}}=\sqrt{\overline{zz-pz}}$. And PQ being $=q$. $DQq\ (=DPq+PQq)=zz-pz+qq$; therefore $DQ=\sqrt{\overline{zz-pz+qq}}$.

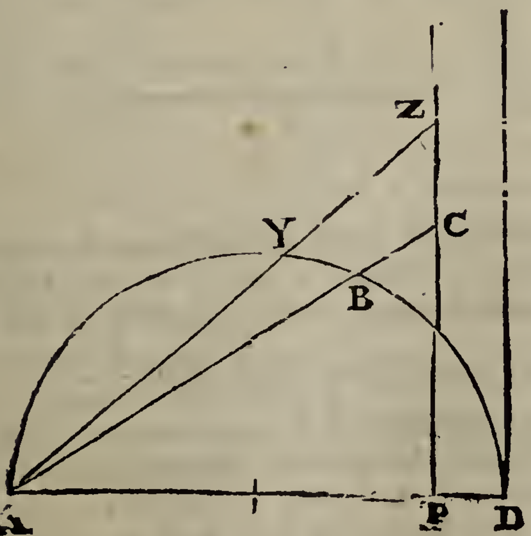
Having found $dQ=\sqrt{\overline{zz-pz+qq}}$; I draw Az (See *Fig.* 2.) $-dQ$, and then (as in the former Example) find $mr=y$, which being much leſs than z (or Az, *Fig.* 3.) I find that I have err'd in my Suppoſition of z. And conſidering that (See *Fig.* 3.) the bigger Az is, the bigger will dQ be alſo, and conſequently mr the leſs; I try again with a leſſer z, and at laſt find, that making AZ (*Fig.* 3.) $=z$, DQ will be $\sqrt{\overline{zz-pz+pq}}$, to which I make AZ (*Fig.* 2.) equal, and thereby find $mR=y=z$, which is therefore the Root, and the Scale ſhews the Number to be $6=x$.

For another Example, may be propoſed the doubling of the Cube; that is, having the Root or Side of a Cube given, to find another Line whoſe Cube ſhall be double the former Cube. In this Caſe, let AB (*Fig.* 1.) be the Side of the given Cube, $mC=2AB$, $Az=z$, the ſought Root taken by gueſs, by which finding mr (as above) if $mr=Az$, then is Az the Root of the double Cube ſought, elſe another Trial muſt be made,

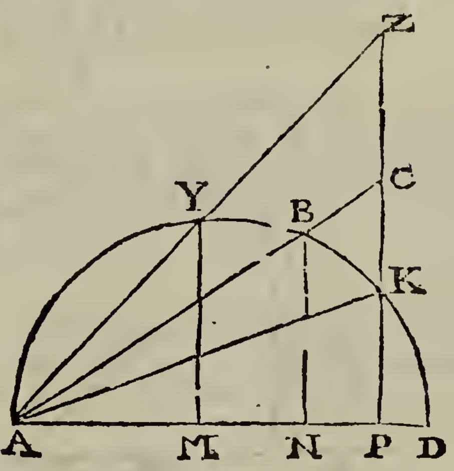
$ABQ : Azq :: mr : nS = mc = 2AB$; therefore, $2AB\times ABq = 2AB$, cub. $= Azq\times mr = Az$ cub. (when $Az=mr$).

Several things might be added, conducing to a more ready determining of the Root ſought; which any one who ſhall think fit to make Trial, may himſelf obſerve and make uſe of.

By ſomething alike Method may Biquadratick Equations be conſtructed alſo, and if the loweſt Term be wanting, as eaſily as a Cubick. Of which I'll here give you an Inſtance. Suppoſe this Biquadratick Equation, $x^4+px^3+q^2x^2=n$. I divide n by a leſs ſquare Number, ſuppoſe b^2 the Quotient, I call $CC\ \frac{n}{bb}=CC$, then $n=b^2C^2$. I divide alſo the other Side of the Equation into two Multipliers, *viz.* $\overline{x^2\times 2x^2\pm px\pm qq}=b^2\times C^2$, whence $x\times\sqrt{\overline{x^2\pm px\pm qq}}={}^{\prime}\times C$. Or, ſubſtituting y and z for x (as I do in Cubes) while x is unknown, $q\times\sqrt{zz\pm pz\pm qq}=b\times C$. I take z by gueſs, and therewith find $\sqrt{\overline{zz\pm pz\pm qq}}$ (as is done in the ſecond Example of Cubic Equations) In a convenient Semicircle ABD, I apply the Chord $AB=b$, and producing it, make $AC=c$. [But if b be greater than c, I make $AB=c$, and $AC=b$.] Thro' C, I draw ZCP, perpendicular to AD, and applying $AZ=\sqrt{\overline{zz\pm px\pm qq}}$, ſo is the intercepted Chord $AY=y$, and if $y=z$, then is either equal to x, the Root ſought. Elſe Trial muſt be made with another x.



I might have taken the Biquadratick Root of n, and then $b-c$, to which the Diameter AD muſt have been equal; the Demonſtration depends on this, that $AY\times AZ=AB\times AC$, which I thus prove, (having drawn AK to the Interſection of ZP with the Semicircle) $ABq : AKq :: (An : AP ::)\ AB : AC \therefore AB\times AC=AKq$. By a like Reaſon, $AYq : AK :: (AM : AP ::)\ AY : AZ \therefore AY\times AZ=AKq=AB\times AC$.



The ſame Method will hold for complete Biquadraticks, but will be too operoſe.

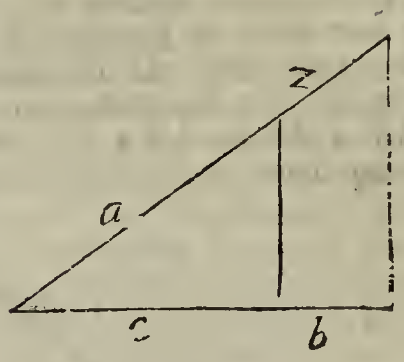
See Mr. *Halley*'s Conſtruction of Cubicks and Biquadraticks, in *Phil. Tranſ.* N°. 188, 190. As alſo *Bernoulli*'s Animadverſions on the *Carteſian* Geometry, in the *Act. Erud. Lip.* 1. for *June* 1688. And his *True Geometrical Conſtruction of Solid, and more than Solid, Problems, by Right-lines and Circles only*, for the Month of *Sept.* 1689.

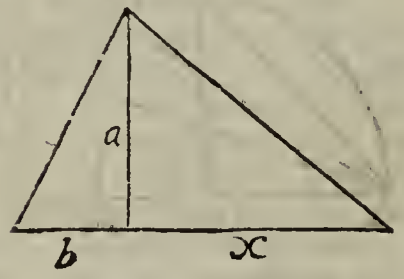
Dr. *Gregory*, in his Preface to his Excellent *Oxford Euclid* in G. L. ſhews that all Quadratic Equations may be conſtructed from the 58 and 59 of *clides Data*.

CONSTRUCTION *of Equations* [in *Algebra*] is the contriving ſuch Lines and Figures as ſhall demonſtrate the Equation, Canon, or Theorem, to be true, Geometrically. And this is often of great Uſe to ſolve and illuſtrate Algebraical Equations: And the Manner of it you will ſee in the following Rules, which ſhew you how to reſolve ſimple Equations into Proportionals, and to build a Geometrical Conſtruction thereupon. *L.*

1. Thus if $\frac{ab}{c} = z$, then $c : b :: a : z$; by 12. *e.* 6. *Euclid.*

Or, if $\overset{a}{\ }b^{a} = x$, then $b : a :: a : x$.





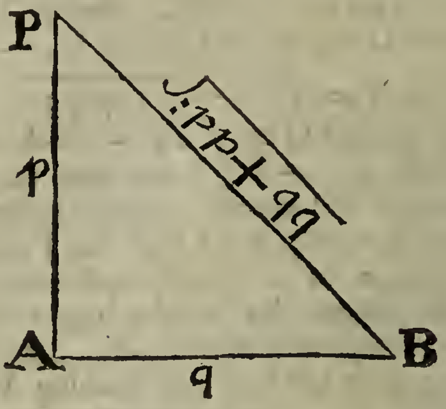
Or, if $\frac{ab+ag}{h+i} = x$, then $h+i : b+g :: a : x$.

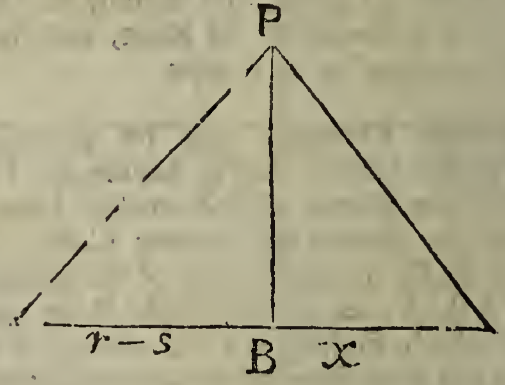
Or, if $\frac{ab+ag}{h+i} = x$, then $h-i : b+g :: a : x$.

2. If $\frac{ab+mn}{r-s.} = x$, the Conſtruction and Solution will be more difficult, becauſe no Letter in the Numerator is taken twice; but that it may be ſo, and that (a) (for Inſtance) may be twice us'd, make, as $a : n :: m :$ to a fourth Proportional, which call p; then $nm = ap$, and conſequently, $\frac{ab+ap}{r+s} = x$; wherefore, by *Rule* 1, $r+s : b+p :: a : x$.

Or, if this Equation were propoſed, $\frac{ab+m}{r-s} = x$, firſt find a mean Proportional between a and b, which ſuppoſe to be p; alſo another mean Proportional between m and n, which let be q; then the Equation will ſtand thus, $\frac{pp+qq}{r-s} = x$.

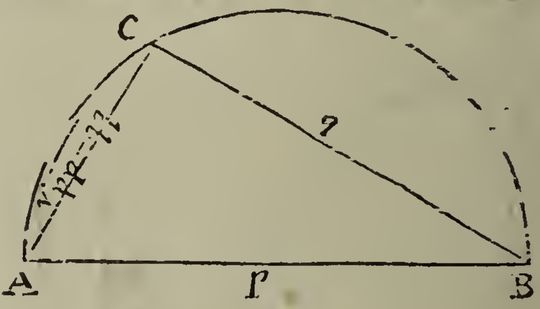
Let therefore a Right-angular Triangle be made, wherein the Perpendicular $AP = p$, and the Baſe $AB = q$; therefore ſhall $PBq = pp+qq$, which, ſince, according to the Equation, it is to be divided by $r-s$, make, as $r-s : PB \ (=\sqrt{pp+qq}) :: PB :$ to a Third Proportional, and that ſhall be x ſought.





3. In this Equation, $\frac{ab-mn}{c+d} = y$.

Firſt, Make, as $a : m :: n : p$, a Fourth Proportional; then will $\frac{ab-ap}{c+d} = y$, and conſequently (as in *Caſe* 3.) $c+d : b-p :: a : y$.



Or you might (as in *Caſe* 2.) have found a mean Proportional between a and b, as alſo between m and n, which being called (as there) p and q, the Equation would have ſtood thus, $\frac{pp-qq}{c+d} = y$: Then having taken $AB = p$, and on it, as a Diameter, drawn a Semicircle, and applying in $BC = q$, the Square of AC will be $= pp-qq$; which, ſince it is to be divided by $c+d$, make, as $c+d : AC :: AC : y$, the Quantity ſought.

4. Let this Equation $\frac{aabc}{ffg} = z$ be propoſed:

Firſt, Find out (p) a Third Proportional to f and a, then $fp = aa$; the Equation will ſtand thus, $\frac{fpbc}{ffg} = z$; that is, $\frac{pbc}{fg} = z$.

Secondly, Find a Fourth Proportional (q) to f, p and b, ſaying, as $f : p :: b : q$; then will $fq = pb$, and conſequently the Equation will ſtand thus, $\frac{fqc}{fg} = z$, that is, $\frac{qc}{g} = z$; and therefore (as *Rule* 1.) $g : q :: c : z$, ſought.

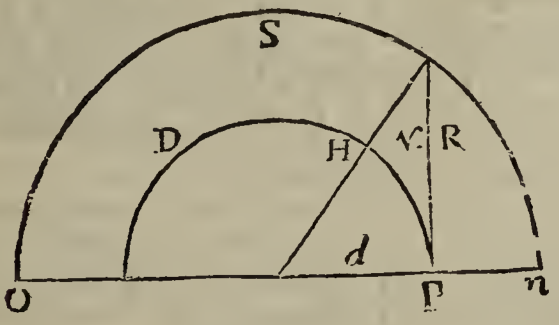
5. If this Equation $\frac{hkk}{mm} = z$ were propoſed,

Firſt, Find a Fourth Proportional to m, h and k, which let it be p; therefore $pm = hk$, and conſequently the Equation will ſtand thus, $\frac{pmk}{mm} = x = \frac{pk}{m}$; therefore $m : p :: k : x$, ſought.

Conſtruction of all the three Forms of Quadratick Equations, *according to Mr.* Oughtred's *Method of Solution.*

Draw two Concentrick Circles, as in the Figure, and let the Diameter of the greater be called S, and the Diameter of the leſſer be D.

Which Letters, S and D, do repreſent the Sum and Difference of the Roots found, as H and d do the Half Sum and Half Difference.



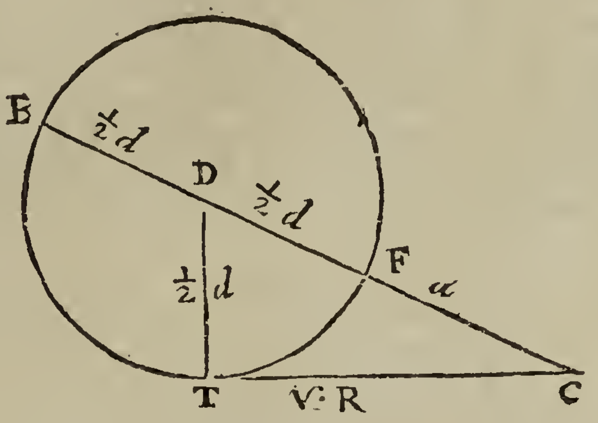
Since therefore his Theorem is, that $SS - DD = 4R$, let $\sqrt{}:\overline{R}$ be made a Tangent to the leſſer Circle, and a Right-Sine in the greater, and draw the Hypothenuſe H, and call the Baſe of the Triangle, d.

Then will $HH - dd = R$ (*viz.* $\frac{1}{4}SS - \frac{1}{4}DD = R$); wherefore $HH = R + dd$; and therefore $H = \overset{1}{\sqrt{}}:\overline{R + dd}$: Thus H, if required, is found: Or, if H had been given, and d required. Now ſince $HH - R = dd$, therefore $\overset{2}{\sqrt{}}:\overline{HH - R} = d$.

And having thus found H and D, then $H + d$ ($= Op$) = the greater Root a; and $H - D$ ($= pn$) = the leſſer Root e, which will be Affirmative or Negative, according to the Form of the Equation.

CONSTRUCTION *of Quadraticks*, after another Method, in Imitation of *Des Cartes*.

In the firſt Form, which is $aa + da = R$, Let $FC = a$, the leſſer of the two Roots, and DF or $DT = \frac{1}{2}d$, *i. e.* Half the Coefficient.

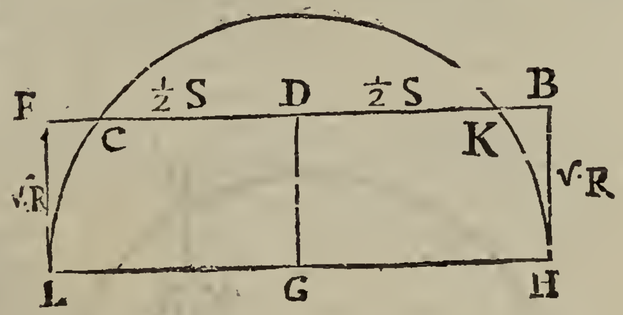


Then will $BC = d + a$, and conſequently ▯ BCF = □ TC, by 36 *e.* 3 *Euclid.*
That is, $aa + da = R$.

In the Second Form, which is $aa - da = R$; Make $BC = a$, the greater of the two Roots, and DF or $DT = \frac{1}{2}d$ (Half the Coefficient;) Then will ▯ BCF = □ TC (by 36 *e.* 3.) or $aa - ad = R$.

In the Third Form, which is $Sa - aa$R, Let $FB = S$, and CB or $FK = a$ (the greater Root;) Then will FC or $KB = S - a$.

But by 36 *e.* 3 *Eucl.*
▯ CBK or KFC = □ BH or $\overline{FL}$;
That is, $Sa - aa = R$.



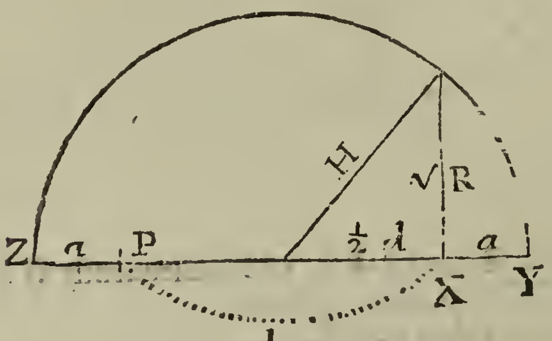
But if KB be ſuppoſed equal to a (the leſſer Root) then will $KF = S - a$.

But ▯ KFC = □ FL; that is, $Sa - aa = R$; by 36 *e.* 3 *Eucl.*

The three Forms of Quadraticks *may alſo be conſtructed another Way, after the following Manner, which agrees very well with* Harriot's *Method of Solution, by compleating the Square.*

Thus : Suppoſe $aa + da = R$:

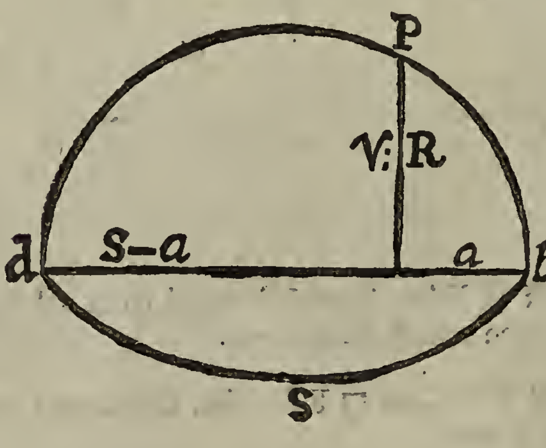
Draw a Line at Pleaſure, and on it ſet the Coefficient *d*, and biſect it : At any End of it erect perpendicularly a Right-line equal to the $\surd : R$. Then, with the Diſtance between the Top of the Line and the Middle of *d*, deſcribe a Circle, which will give you *a*, as you ſee; for then $\surd : R$ will be a mean Proportional, and $aa + ad = RR$, by 14 *e.* 6 *Eucl.*



And here 'tis plain, that if to R, the known or abſolute Number, you add the Square of Half the Coefficient, or of $\frac{1}{2} d$, 'twill give you the Square of H, or of $\frac{1}{2} d + a$; from the Root of which, at laſt taking $\frac{1}{2} d$, there will remain *a*, the leſſer of the two Roots ſought.

In the Second Form, where $aa - da = R$, Let zx be ſuppoſed $= a$, then will $xy = a - d$; and conſequently (all things being conſtructed as before) $aa - ad = R$ (by 14 *e.* 6 *Eucl.*) And here, as before, $Q \frac{1}{2} d - R = HH$, which is equal to $Q \frac{1}{2} d + xr$; to the Square-Root of which, adding $\frac{1}{2} d$, you have zx or $py = a$.

As to the Third Form, *viz.* $Sa - aa = R$, where the Coefficient is the Sum of the Roots; on



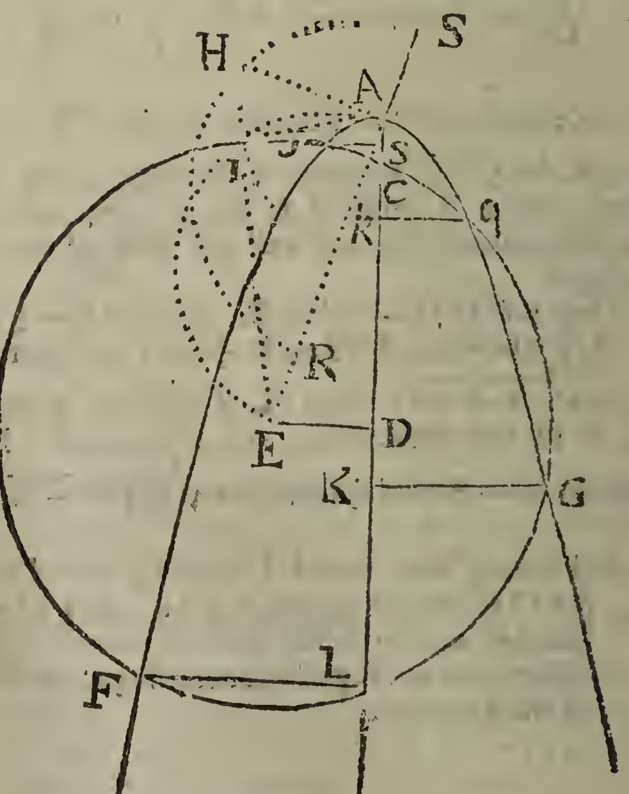
S, as a Diameter, draw the Circle *d p b*, then apply in a Line equal to the Square-Root of R, the abſolute Number perpendicularly as before ; and then will $S - a . \surd : R :: \surd : R . a$; (for ſince S = to the Sum of the Roots, if either be *a*, the other muſt be $S - a$) and therefore $Sa - aa = R$.

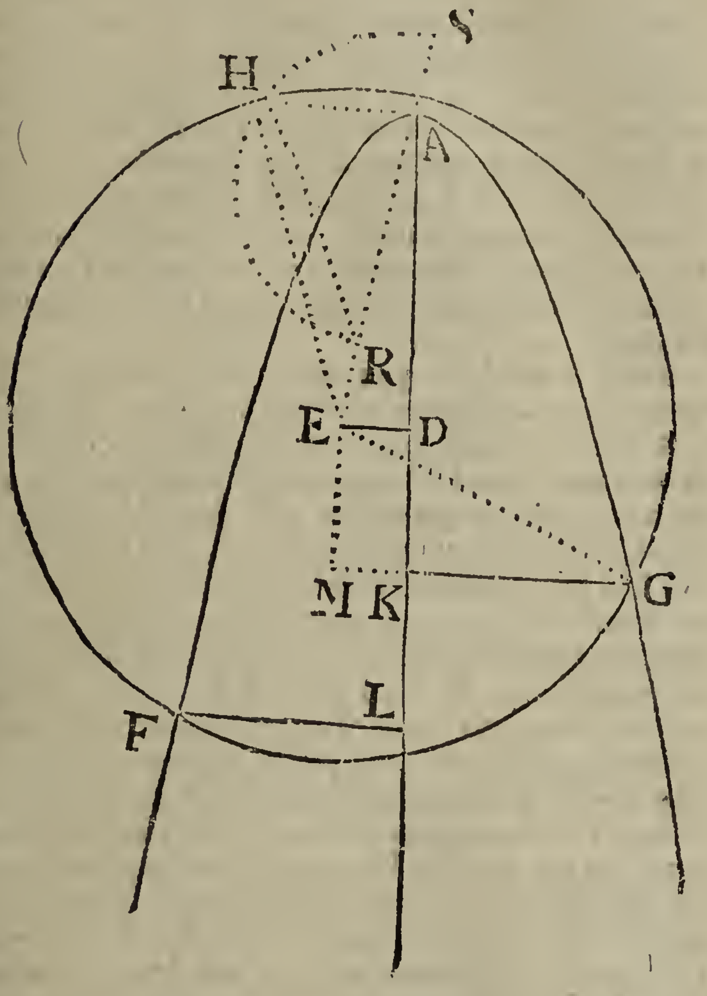
CONSTRUCTION *of Cubick and Biquadratick Equations in Algebra.*

This, I believe, was firſt done by ***Des Cartes***, who (in the third Book of his excellent Geometry) hath given us a Method for the conſtructing and finding the true Roots of all Equations, not exceeding four Dimenſions, by Means of a Parabola and a Circle ; which Method was indeed not perfect, becauſe it would not conſtruct any Equations, but ſuch as had their ſecond Term firſt taken away: However, becauſe it was that which gave the firſt Riſe to ***Baker***'s excellent Rule, and to whatever Improvements have been ſince made in it, 'tis proper to give you an Account of it in the firſt Place.

When the Second Term is wanting, ***Des Cartes*** reduces all ***Cubick Equations*** to this Form, $Z^3 . * . apz, aaq = 0$; and ***Biquadraticks*** to this, $z^4 . * . apzz, aaqz, aaar = 0$; where *a* ſtands for the ***Latus Rectum*** or ***Parameter*** of any given ***Parabola***, and is ſuppoſed equal to 1, that its Power may produce no Trouble in Operation : By which Means the former Equations will ſtand thus, $Z^3 . * . pz, q = 0$, and $Z^4 . * . pzz, qz, r = 0$.

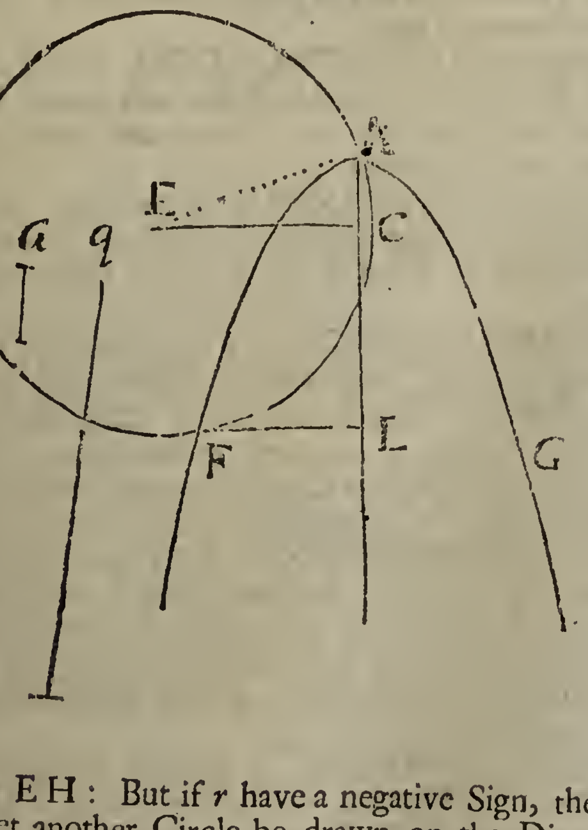
Let then any Parabola, as F A G, be ſuppoſed to be deſcribed, whoſe Axis is A C D K L, and its Parameter $1 = a$, make A C equal to $\frac{1}{2} a$, ſo that the Point C will always be within the Parabola: Then take in the Axis (downwards from C, if *p* have a Negative Sign, but upwards in the Axis produced when it hath a Poſitive one) C D equal to $\frac{1}{2} p$. Then from the Point D (or C, if the Quantity *p* be wanting in the Equation) erect a Perpendicular to the Axis, as D E, and make it equal to $\frac{1}{2} q$; which D E muſt be on the Right-hand, if it have a Negative Sign ; but on the Left, if it be $+ q$. After which, deſcribing a Circle on the Centre E, with the Radius E A, it will (if the Equation be





only a Cubick one) cut the Parabola in as many Points as the Equation hath true Roots; and the affirmative ones will be Ordinates or Perpendiculars let fall from thence to the Axis on the Right-hand; and the negative Roots, Perpendiculars let fall on the Left-hand of the Axis.

But if the Equation be a Biquadratick one, the fourth Term r being there, and having a poſitive Sign, then from A take $AR = r$, and produce $AS = c$ or 1. Make R S the Diameter of a Circle, and at A erect H A perpendicularly; I ſay, the other Circle muſt paſs through H, and its Radius



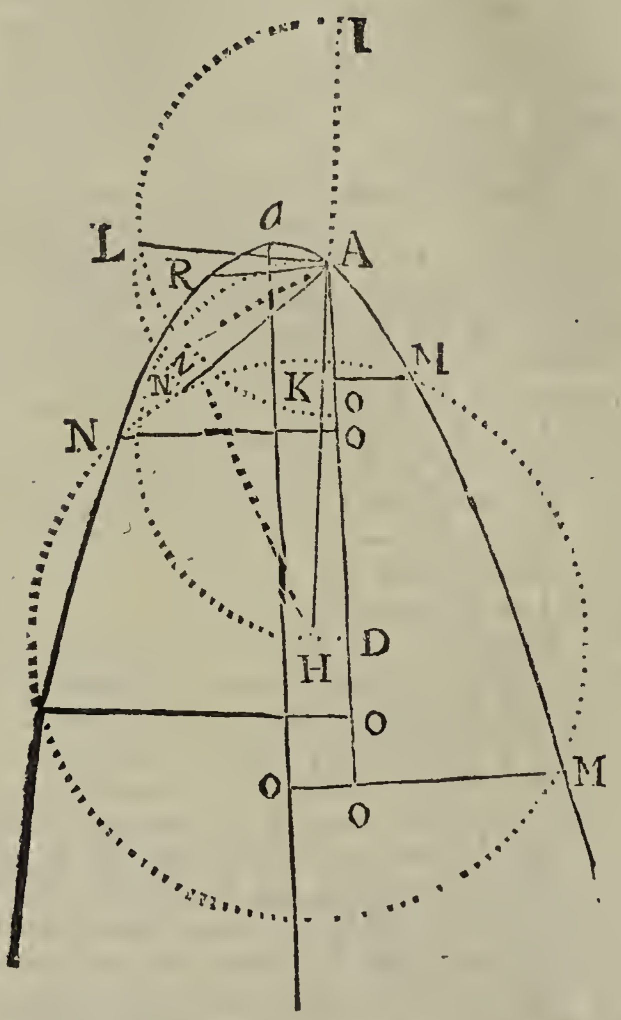
will be E H: But if r have a negative Sign, there muſt yet another Circle be drawn on the Diameter A E, in which A I muſt be applied equal to A H, and that will find the Point I, thro' which the interſecting Circle muſt paſs, and whoſe Radius will be I E, and Centre E; which Circle may cut the Parabola in 1, 2, 3, or 4 Points, from whence perpendicularly let fall to the Axis, will be all the Roots, whether Affirmative or Negative; the former of which will be on the ſame Side with the Centre E, when 'tis $+q$, and on the other Side the Axis when 'tis $-q$.

The Demonſtration of all which he thus very eaſily gives us: If the Ordinate G K, by this Conſtruction found, be called Z, then the Abſciſſa A k will be Z Z, becauſe the Ordinate is a mean Proportional between the Parameter (here 1) and the Abſciſſa (by the firſt Property of the Parabola;) wherefore, if from A K you take $AC = \frac{1}{2}$, and alſo $CD = \frac{1}{2}p$, you will find, by that means, the Remainder D K or E M, which, in this Notation, will be $ZZ - \frac{1}{2}p - \frac{1}{2}$ (*See Figure the Firſt*) whoſe Square will be $Z^4 - ZZp - ZZ + \frac{1}{4}pp + \frac{1}{2}p + \frac{1}{4}$. And becauſe, by the Conſtruction, D E or $KM = \frac{1}{2}q$, the whole G M will be $= Z + \frac{1}{2}q$, and its Square will be $ZZ + qZ + \frac{1}{4}qq$. And then this and the former Square of E M together, and you will have the Square of the Radius E G, $Z^4 - ZZp + qZ + \frac{1}{4}pp + \frac{1}{4}qq + \frac{1}{2}p + \frac{1}{4}$ (by 47 *e. Eucl.*) which Radius, or its Equal E H, may be expreſſed another way, if we conſider that $ED = \frac{1}{2}q$, and $AD = \frac{1}{2}p + \frac{1}{2}$, for then the Hypotheneuſe E A will be $\surd : \frac{1}{4}qq + \frac{1}{4}pp + \frac{1}{2}p + \frac{1}{4}$. Wherefore, ſince A H is a mean Proportional between $AS = 1$, and $AR = r$, it muſt itſelf be noted by $\surd : r$; Alſo, ſince E A H is a Right-angle, the Square of E H = the Sum of the Squares of H A and E A, that is, □ of H E or $EG = \frac{1}{4}qq + \frac{1}{4}pp + \frac{1}{2}p + \frac{1}{2} + r$; which laſt Quantity being equal to $Z^4 - ZZp + qZ + \frac{1}{4}pp + \frac{1}{4}qq + \frac{1}{2}p + \frac{1}{4} = \square EG$, as was proved before: If you compare them together, you will find this Equation to ariſe $Z^4 = .*. + pZZ - qZ + r$; whence 'tis plain I K is the true Root. *Q. E. D.*

Thus far went *Des Cartes* in this Matter; but he conſidering only the Axis of the Parabola, and not thinking of what might be done by the other Diameters, could not conſtruct any Equations, but from which he had firſt ejected the ſecond Term. But our *Baker* took the Diameters or Parallels to the Ax alſo into Conſideration, and by that means did exceedingly perfect and improve this Conſtruction of *Des Cartes*, and made it univerſal for all Equations not exceeding four Dimenſions, without any previous Reduction of them, or taking any of the Terms.

And his Method is this, as you may find in his *Clavis Geometrica.*

Taking any Parabola, let the *Parameter* or *Latus Rectum* be called $1 = L$ (that ſo the Power of L may create no Trouble) and its Vertex a; then, at Right-angles to the Axis, inſcribe $RA = \frac{1}{2}p$ (for Half the ſecond Term in the Equation) and then ſhall its Point A be the Vertex of the Diameter A D, to be drawn parallel to the Axis; ſo that the Diſtance of this Diameter from the Axis is always $\frac{1}{4}$ of p, or $\frac{1}{4}$ of pL (for L is equal but to 1); and conſequently, when $p = 0$, or when the ſecond Term is wanting (as in *Des Cartes* his Conſtruction) A D will be in the Axis, and the Points, R, a, and A, all coincident. Next in this Diameter A D, he determines the Point D by the Length of A D, and then erects in D a Perpendicular to D A, as D H, whoſe Length he determines alſo, and by that means find H the Centre of the Circle, which is to interſect or touch the Parabola: And



And this he performs by what he calls his *Central Rule*, *viz.*

$$1.\ \frac{L}{4}+\frac{pp}{8L}\pm\frac{q}{2L}=b=AD\text{; And,}$$

$$2.\ \frac{p}{2}\pm\frac{ppp}{6LL}\pm\frac{pq}{4LL}+\frac{r}{2LL}=d=DH.$$

Which two Rules are demonſtrated in his Book and here, under the Word *Central Rule*, which ſee; and becauſe L = 1, they may be contracted thus,

$$1.\ \frac{1}{4}+\frac{pp}{8}\pm\frac{q}{2}=B=AD.$$

$$2.\ \frac{p}{2}+\frac{ppp}{6}\pm\frac{qp}{4}\pm\frac{1}{2}r=d=DH.$$

And you muſt obſerve, that in the former of theſe Rules + ſignifies downwards from the Point A, and — upwards from it; and in the latter Rule + ſignifies towards the Left-hand, as — doth towards the Right; ſo, according as the Affirmative or negative Roots prevail, H will be on the Left or Right-hand of D.

And in both Parts if pq or r be $=o$, the Member where it is found will vaniſh and become alſo $=o$.

As to the Signs of the Quantities in his Rule, he makes p always retain the Sign it hath in the Equation, but q always puts on a contrary one to what it had there; r is always with a poſitive Sign, except when pr have contrary Signs in the Equation, and then r will always have a negative Sign in the Rule.

Having thus, by his Central Rule, found H the Centre of the Circle, the next Work is to determine the Radius; and if the Equation be no higher than a Cubick, H A is always the Radius; but if it be a Biquadratick, then ſuppoſing —S, or that the fifth Term (or abſolute Number) be a negative Quantity, take in the Line A H (produced both ways if there be Occaſion) A I = L above, and A K = S; and making I K a Diameter, deſcribe the Semicircle K L I, and erect at the Point A the Line A L perpendicularly; which therefore will be a mean Proportional between A K and A I: I ſay, the Circle muſt paſs through L, and H L will be the Radius.

But if it be + S, you muſt draw another Diameter H A, and therein fit in or apply A Z = to L A before found, (for now the Square of A L is to be taken from H A, as in the former Caſe it was to be added to it) which will find the Point Z through which the Circle muſt paſs, and the Radius will be H Z, which Circle being drawn, it will cut the Parabola in 4, 3, 2 or 1, or in no Point; and according to the Number of ſuch Interſections, will the real Roots of the Equation be found, which will be always ſo many Perpendiculars from thoſe Points to A D, as, *e. gr.* N O on the Left-hand, M *o* on the Right, &c. Of which, if there be no *p* or ſecond Term, and alſo it be — *r*, then on the Left-hand are the poſitive Roots, and the negatives ones on the Right-hand: But if the ſecond Term be there, and with a negative Sign, as — *p*, then N *o* on the Left-hand are Affirmative, and the others M *o* on the Right, Negative; but if it be + *p*, 'tis, on the contrary, N *o* Negative, and M *o* Poſitive.

The Demonſtration of all which is very eaſy to one that hath conſidered the Demonſtration above given from *Des Cartes*, on which this entirely depends; taking into Conſideration alſo the Property of the Parabola, which *Baker* had from Mr. *Strode* of *Maperton*, that *The Latus Rectum* : *Is to the Sum of any two Ordinates* : : *As their Difference* : *Is to the Difference of the Abſciſſæ.*

CONSTRUCTION, [in *Grammar*] is the natural, juſt, and regular placing and diſpoſing of Words in a Diſcourſe, ſo as to make proper and intelligible Senſe; and is either *Simple* or *Figurative.*

Simple CONSTRUCTION, is that wherein all the Terms or Parts of the Diſcourſe are placed in their natural Order.

Figurative CONSTRUCTION, is that wherein the Simplicity is receded from, and certain Expreſſions are uſed, that are ſhorter and more elegant than Nature affords.

CONSUETUDINIBUS *& Servitiis*, [in *Law*] a Writ of Right that lies againſt the Tenant, that deforceth his Lord of the Rent or Service due to him.

CONSULTATION, is a Writ whereby a Cauſe, being formerly removed by Prohibition from the Eccleſiaſtical Court, or Court Chriſtian, to the King's Court, is returned thither again; for the Judges of the King's Court, if, upon comparing the Libel with the Suggeſtion of the Party, they do find the Suggeſtion falſe, or not proved, and therefore the Cauſe to be wrongfully called from the Court Chriſtian, then, upon this Conſultation or Deliberation, they decree it to be returned again; whereupon the Writ in this Caſe obtained is called a *Conſultation.*

CONSUMPTION, in general, ſignifies a Defect of Nouriſhment, or the conſuming, waſting or decaying of the Body, and particularly of the muſcular Fleſh: 'Tis frequently attended with a hectick Fever, and is divided into ſeveral Kinds according to the Variety of its Cauſe, and the Parts it principally affects, as a Scorbutick Conſumption, a Conſumption of the Lungs, *&c.*

CONTACT, [*Contactus, L.*] is when one Line, Plane, or Body is made to touch another, and the Parts that do thus touch, are called the Points or Places of *Contact*.

CONTAGION, the communicating or tranſferring of a Diſeaſe from one Body to another, by certain Steams or Effluvia tranſmitted from the Body of the ſick Perſon. Some Diſeaſes are Contagious by immediate Contact or Touch, as the Madneſs of a Dog, which is communicated by biteing; and the Venom of the French-Pox, which is tranſmitted from the infected Perſon in the Act of Copulation; ſometimes the Contagion is propagated by infected Cloaths, as in the Itch and Leproſy; and there are ſome Contagions that are tranſmitted through the Air to a conſiderable Diſtance, as the Plague and other peſtilential Diſtempers; in which Caſe the Air is ſaid to be contagious, that is, full of contagious Particles or Effluvia. *L.*

CONTEMPLATION, is the preſerving of the Idea which is brought into the Mind for ſome time actually in View. *L.*

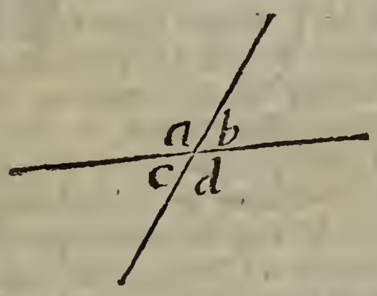
CONTENEMENT, ſeems to be Freehold Land which lies next a Man's Tenement or Dwelling-Houſe, that is, in his own Occupation.

CONTENT, [in *Solid Geometry*] is the Meaſure of any ſolid Figure, *viz.* in Cubick Inches or Feet, *&c.*

CONTIGUITY, [*Contiguitas, L.*] is only the Surface of one Body's touching that of another. But Continuity is the immediate Union of the Parts which compoſe any natural Body, ſo that one cannot tell where one begins, and another ends.

CONTIGNATION, [in *Architecture*] a Story in Building, the laying of Rafters together. *L.*

CONTIGUOUS *Angles*, [in *Geometry*] are ſuch as have one Leg common to each Angle, and are otherwiſe called *Adjoining Angles.* Thus, the Angle *a* and *d* are called *Contiguous Angles*, but *b* and *c Oppoſite* or *Vertical.* See *Angle.*



CONTINENT, [in *Geography*] is a great Extent of Land, which comprehends ſeveral Regions and Kingdoms, and which is not interrupted or ſeparated by Seas.

CONTINENT Cauſe of a Diſtemper, is that on which the Diſeaſe depends ſo immediately, that it continues ſo long as that remains, and no longer. Thus a Stone ſticking in the Ureters, is the continent Cauſe of a Suppreſſion of Urine.

CONTINENT *Fever*, is that which performs its Courſe without either Intermiſſion or Remiſſion.

CONTINGENT, is a caſual Event, which may or may not happen to come to paſs. 'Tis ſometimes alſo in Mathematicks uſed for the Word Tangent.

CONTINGENT *Line*, [in *Dialling*] is ſuppoſed to ariſe from the Interſection of the Plane of the Dial with the Plane of the Equinoctial; and conſequently in this Line the Hour Lines of the Dial and the Hour Circles interſect each other. This Line is always at Right-angles with the Subſtilar Line.

CONTINGENT *Line*, the ſame with *Tangent Line.*

CONTINGENT *Uſe*, [in *Law*] is an Uſe limited in a Conveyance of Land, which may or may not happen to veſt, according to the Contingency expreſſed in the Limitation of ſuch Uſe.

CONTINUAL *Claim*, is a Claim made from time to time within every Year and Day, to Land, or other Thing, which, in ſome Reſpect, we cannot attain without Danger.

CONTINUAL *Fever*, is that which ſometimes remits or abates, but never perfectly intermits; that is, the ſick Perſon is ſometimes better, but never perfectly free from the Fever.

CONTINUAL *Proportion*, *Arithmetical* and *Geometrical.* See *Progreſſion.*

CONTINUANDO, is a Word uſed in Law, when the Plaintiff would recover Damages for ſeveral Treſpaſſes in the ſame Action: For in one Action of Treſpaſs they may recover Damages for divers Treſpaſſes, laying the firſt with a *Continuando* to the whole Time, and in this Form;

CONTINUANDO *Tranſgreſſionem prædictam, &c. a prædicto die, &c. uſque talem diem*; ſo including the laſt Treſpaſs. *L.*

CONTINUED *Quantity*, or a *Continuum*, is that whoſe Parts are inſeparably joined and united together, ſo that you cannot diſtinguiſh where one begins and another ends. See *Diſcrete Quantity.*

CONTINUED *Proportion*, [in *Arithmetick*] is that wherein the Conſequent of the firſt Ratio, is the ſame with the Antecedent of the ſecond, as 4 : 8 :: 8 : 16.

And, on the contrary, if the Conſequent of the firſt Ratio be different from the Antecedent of the ſecond, the Proportion is ſaid to be diſcrete, as 3 : 6 :: 4 : 8.

CONTINUED *Zocle.* See *Zocle.*

CONTINUED *Baſe*, [in *Muſick*] is that which continues to play conſtantly, both during the Recitatives, and to ſuſtain the Choir or Chorus, the ſame as Thorough Baſe.

CONTINUITY, [*Continuitas L.*] is, as the Schoolmen uſually define it, the immediate Coheſion of Parts in the ſame Quantum, but others define it a Mode of Body, whereby the two Extremes become one; others define it a State of Body reſulting from the mutual Implication of its Parts. And it is of two Kinds.

Mathematical CONTINUITY, which is merely imaginary and fictitious, becauſe it ſuppoſes real or phyſical Parts where there are none.

Phyſical CONTINUITY: This is ſtrictly that State of two or more Parts or Particles, whereby they appear to adhere or conſtitute one interrupted Quantity or Continuum; or between which no intermediate Space is perceived. The Schoolmen again diſtinguiſh it into two other Kinds of Continuity; as,

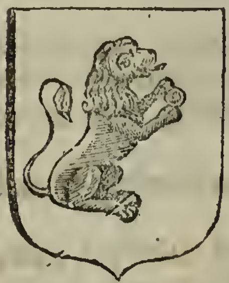
Homogeneous CONTINUITY, is that where the Bonds or Extremes of the Parts are not perceived by our Senſes, and this agrees even to Water, Air, *&c.*

Heterogeneous CONTINUITY, is where the Extremes of certain Parts are indeed perceived by the Senſes, yet, at the ſame time, the Parts are obſerved to be cloſely link'd to each other, either in Virtue of their Situation, Figure, *&c.*; and this is chiefly attributed to the Bodies of Animals and Vegetables.

CONTINUUM, or *continued Quantity* [in *Phyſicks*] is a Quantity or Coextenſion, the Parts of which are not divided ; but are joined or connected together, ſo as to leave no Room to determine, where one begins and the other ends.

CONTOUR, [in *Painting*] the Out-line, or that which terminates and defines a Figure : The Contour of a Figure makes what we call the Draught or Deſign ; the Contour of a Face is the Lineaments of it.

CONTOUR, [in *Architecture*] the Out-line of any Member, as that of a Baſe, a Cornice, or the like.



CONTOURNE [in *Heraldry*] ſignifies a Beaſt ſtanding or running to the ſiniſter Side of the Eſcutcheon, being always ſuppoſed to look to the Right, if not otherwiſe expreſſed, as in the Scutcheon annexed.

CONTOURNIATED [with *Antiquaries*] a Kind of Medaillions, ſtruck with a certain Hollowneſs all around, which leaves a Circle on each Side, and with Figures that have ſcarce any *Relievo*, in Compariſon with the true Medaillions.

CONTRABANDED *Goods*, are ſuch as are prohibited by Act of Parliament or Proclamation to be imported into, or exported out of this into other Nations.

CONTRACT, is a Covenant or Agreement, with a valuable or lawful Cauſe or Conſideration ; or elſe one Thing muſt be given for another, which is called *Quid pro quo* ; as if I ſell my Horſe for Money, or covenant to make you a Leaſe of my Manor in Conſideration of ſo much Money ; theſe are good Contracts, becauſe one Thing is given for another : But if a Man make Promiſe to me that I ſhall have Twenty Shillings, and that he will be Debtor to me thereof ; and after I ask the Twenty Shillings, and he will not deliver it, yet I ſhall never have an Action to recover, becauſe the Promiſe was no Contract, but a bare Promiſe, and *ex nudo Pacto non oritur Actio* : But if any thing were given for the Twenty Shillings, though it be but the Value of a Penny, then had it been a good Contract.

CONTRACTILE, is a Word uſed by ſome Phyſicians to expreſs ſuch Muſcles, and other Parts of the Body, as are uſually contracted.

CONTRACTILE *Force*, that Power or Property inherent in certain Bodies, whereby they are enabled to draw themſelves up again, after they have been extended, to their former Dimenſions.

CONTRADICTORY *Propoſitions*, [in *Logick*] are either ſuch as conſiſt of an Univerſal and Particular, of which one affirms, and the other denies, as thus ; *All Right-lined Triangles have the Sum of their Angles equal to two Right ones* ; *ſome Right-lined Triangles have not the Sum of their Angles equal to two Right ones* ; or elſe they are both Singular and Particular, one affirming, the other denying the ſame Thing, as the *Circle is Squarable*, *the Circle is not Squarable*.

CONTRA-*Fiſſura*, or *Counter-Fiſſure*, is a Fiſſure on one Side of the Head, occaſioned by a Blow or Fall upon the other. *L.*

CONTRA *Formam Collationis*, is a Writ that lies where a Man hath given Lands in perpetual Alms to any Religious Houſe, Hoſpital, *&c.* For if they alien the Lands, then the Donor or his Heirs may recover them by this Writ, but not of the Alienee, although he be Tenant ; tho' in all other Actions, where a Man demands Freehold, the Writ ſhall be brought againſt the Tenant. *L.*

CONTRA *Formam Feoffamenti*, is a Writ that lies for the Heir of a Tenant infeoffed of certain Lands or Tenements by Charter of Feoffment of a Lord, to make certain Services and Suits to his Court, and is afterwards diſtreined for more than is contained in the ſaid Charter : This Writ lies not for the Plaintiff, who claims to purchaſe from the firſt Feoffee, but for the Heir to the firſt Feoffee. *L.*

CONTRA-HARMONICAL *Proportion*, [in *Arithmetick*] is that Relation of three Terms, wherein the Difference of the firſt and ſecond is to the Difference of the ſecond and third, as the third is to the firſt ; thus 3, 5, and 6 are Numbers contraharmonically Proportional, for 2 : 1 :: 6 : 3.

To find a mean contra-harmonical Proportional to two given Quantities : The Rule is, divide the Sum of the two ſquared Numbers by the Sum of the Roots, and the Quotient will be a contra-harmonical mean Proportional between the Roots.

CONTRA-*Indications*, are divers Conſiderations in a Diſeaſe, that diſſuade a Phyſician from uſing ſuch a Remedy, when other Things induce him to it.

CONTRAMANDATIO *Placiti*, [in *Law*] ſeems to ſignify a Reſpiting, or giving the Defendant further Time to anſwer ; or an Imparlance, or countermanding what was formerly ordered. *L.*

CONTRA *Mure*, [in *Fortification*] is a little Wall built before another Partition Wall to ſtrengthen it, ſo that it may receive no Damage from the adjacent Buildings.

CONTRARY *Propoſitions*, [in *Logick*] are two univerſal Enunciations, of which one affirms, and the other denies ; as *all Squares are Parallelograms* ; *no Squares are Parallelograms*.

CONTRARY *Flexion and Retrogreſſion of Curves*, when a Curve Line as A F K (*Vid. Hay's Fluxions, pag.* 153.)

CONTRARY *Legg'd Hyperbola*, is an Hyperbola, ſo called by Sir *Iſaac Newton*, becauſe its Legs are convex towards contrary Parts, and run contrary Ways. See *Curves*.

CONTRAST [in *Sculpture*, *Painting*, *&c.*] expreſſes an Oppoſition or Difference of Poſition, Attitude, *&c.* of two or more Figures contrived to make a Variety in a Carving, Painting, *&c.* as when in a Group of three Figures, one is ſhewn before, another behind, a third ſide-ways, they are ſaid to be in Contraſt. Some define Contraſt to be an Oppoſition between the Lines which form the Objects.

But beſides the Poſition of the Figures, there is a Contraſt in the ſeveral Members of them, as if the right Arm advance the fartheſt, the right Leg ſhould be hindermoſt, *&c.*

To CONTRAST, [in *Architecture*] is to avoid the Repetition of the ſame Thing, in order to preſent a pleaſing Variety.

CONTRATE *Wheel*, is that Wheel in Pocket-Watches and others which is next to the Crown-Wheel, whoſe Teeth and Hoop lie contrary to thoſe of other Wheels, whence it hath its Name.

CONTRAVALLATION, or, *The Line of Contravallation*, [in *Fortification*] is a Trench guarded with a Parapet, and uſually cut round about a Place by the Beſiegers, to ſecure themſelves on that Side, and to ſtop the Sallies of the Gariſon ; 'tis without

Muſket-Shot of the Town; ſo that the Army forming a Siege, lies between the Lines of Circumvallation and Contravallation.

CONTRAVENTION, [in *Law*] a Man's failing or diſcharging his Word, Obligation, Duty, or the Laws or Cuſtoms of the Place; ſometimes it implies the Non-execution of an Ordinance.

CONTREBANDE, [in *Heraldry*] is, with the *French*, the ſame that we call *Bendy* of ſix *per Bend* ſiniſter counterchang'd.

CONTREBARRE, [in *Heraldry*] is, with the *French*, the ſame that we call *Bend* ſiniſter *per Bend* counterchang'd.

CONTRECHEVRONNE, [in *Heraldry*] ſignifies a Shield parted by ſome Line of Partition.

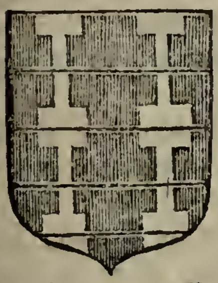
CONTRECOMPONE, [in *Heraldry*] is, with the *French*, what we call *Counter-compone*, and is when the Figure is compounded in two Pieces.

CONTRE-ERMINE, [in *Heraldry*] ſignifies contrary to Ermine, and is a Black filled with white Spots, as Ermine is a White filled with black Spots, and ſome Writers call this *Ermine*. See the *Eſcutcheon*.

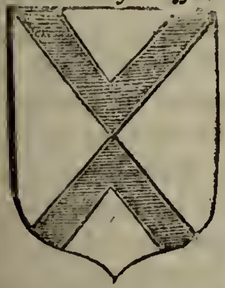
CONTRE-ESCARTELE [in *Heraldry*] ſignifies counter-quarter'd, and denotes the Eſcutcheon, after being quarter'd, to have each Quarter again divided into two, ſo that there may be ſaid (tho' improperly) to be eight Quarters or Diviſions. *F.*

CONTRE-FACE [in *Heraldry*] ſignifies what we call *Barry per Pale* counterchanged. *F.*

CONTRE-PALLE, [in *Heraldry*] is when an Eſcutcheon is divided into 12 Pales parted *per Feſſe*, the two Colours being counterchang'd, ſo that the upper are of one Colour or Metal, and the lower of another. *F.*

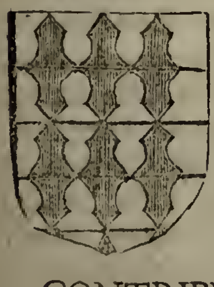


CONTRE-POTENCE, [in *Heraldry*] or *Counter-potent*, is accounted a Furr, as well as Vare and Ermine; but compoſed of ſuch Pieces as repreſent the Tops of Crutches, called in the *French* Tongue, *Potences*, and in old *Engliſh*, *Potents*; and ſome have called it *Vary cuppe* and *Vary taſſe*, as in the Eſcutcheon.



CONTRE-POINTE, [in *Heraldry*] is when two Chevrons in one Eſcutcheon meet in the Points, the one riſing as uſual from the Baſe, and the other inverted, ſetting from the Chief, ſo that they are counter or oppoſite one to the other in the Points, as in the Figure, they may be alſo counterpointed the other Way, *i.e.* when they are founded upon the Sides of the Shield, and the Points meet that Way, which we call *counter-pointed in Feſſe*, and the *French*, *contre-pointe en Faſce*.

CONTRE-*Queve d'yronde*, a Term in Fortification, the ſame with the *Counter-Swallow's Tail*, which ſee.



CONTRE-VAIRE, [in *Heraldry*] is repreſented as in the Eſcutcheon.

CONTRIBUTIONE *Facienda*, is a Writ that lieth where more are bound to one Thing, and but one is put to the Burden: As if Joint-Tenants, or Tenants in Common, hold a Mill, *pro indiviſo*, and are equally to take the Profits thereof; the Mill falling to Decay, and one or more of them refuſing to contribute towards the Reparation, the reſt ſhall have this Writ to compel them. *L.*

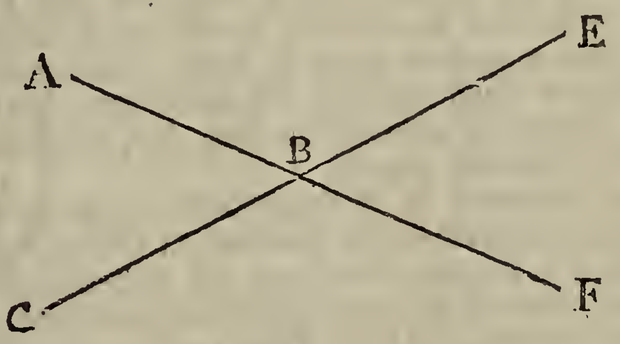
CONTROLLER, is an Officer who keeps a Roll of all other Officers Accounts; and in *England* we have divers Officers of this Name, as *Controller of the King's Houſe*, *Controller of the Navy*, *Controller of the Cuſtoms*, *Controller of Callais*, *Controller of the Mint*, *Controller of the Hamper*, who takes all Things ſealed in Leather Bags from the *Clerk of the Hamper*, and *Controller of the Pipe*, who writes Summons to the Sheriffs to levy the Debts of the Pipe.

CONTUSION of a Bone, is the bruiſing of a Bone by ſome hard and blunt Thing, that though it outwardly appear Whole, yet inwardly it is really Injured and out of Order. *L.*

CONVENTIO, is a Word uſed frequently both in ancient and modern Pleadings at Law. *L.*

CONVENTION, is a Writ that lieth for any Covenant in Writing not performed. *Fitz-Herbert* calls it a *Writ of Covenant. Nat. Brev. Fol.* 145.

CONVERGING, or *Convergent Rays*, [in *Opticks*] are thoſe Rays which, going from divers Points of the Object, incline towards one another, till at laſt they meet and croſs, and then become Diverging Rays. Thus the Rays AB and CB do Converge till they come to the Point B, and then they Diverge and run off from each other in the Lines BE, BF.



CONVERGING *Hyperbola*, is one whoſe Concave Legs bend in towards one another, and run both the ſame Way. See *Curves*.

CONVERGING *Series*, is a Method of Approximation, ſtill nearer and nearer towards the true Root of any Number or Equation, even tho' it be impoſſible to find any ſuch true Roots: Numbers. See *Approximation* and *Square Roots*.

CONVERGING, CONVERGENT *Lines* [in *Geometry*] are ſuch as continually approximate or approach nearer one another, or whoſe Diſtance becomes continually leſs and leſs: Theſe are oppoſite to divergent Lines, the Diſtance of which becomes continually greater; thoſe Lines which converge one way, diverge another.

CONVERSION *of Equations*, [in *Algebra*] is thus; if the Quantity ſought, or any Part or Degree of it be in Fractions, let all be reduced to one common Denomination, (by Multiplication of the Whole, by the Denomination of the Fractional Part) and then omitting the Denominators, continue the Equation in the Numerators only. Thus, ſuppoſe $a - b = \frac{aa + cc}{d} + b + b$; multiply all by d, and it will ſtand thus, $da - db = aa + cc + db + db$. 'Tis called by *Vieta*, *Iſomeria*.

CONVERSION *of Propoſitions* [in *Logick*] is the changing of the Subject into the Place of the Prædicate, and the Prædicate into the Place of the Subject, and yet always retaining the ſame Quantity of both Propoſitions; as, every right-lin'd Triangle hath the Sum of its Angles equal to two right ones, every right-lin'd Figure that hath the Sum of its Angles equal to two right ones, is a Triangle.

CONVEXITY [*Convexitas, L.*] ſignifies any Protuberancy or Swelling out of any thing; as Glaſſes are ſaid to be convex, when they are thicker in the Middle than at the Edges; or rather, when their Surface riſes up regularly (ſo *Vitellio* defines it) above the Plane of the Baſe; as they are concave, when the Surface ſinks down regularly, or with a regular Curvity below it; ſo that the ſame Thing may be, and often is, concave within, and convex without.

Here follows ſome Properties of Convex Glaſſes.

1. If an Object be in the Focus of a Convex Glaſs, and the Eye on the other Side the Glaſs, the Object will appear erect and diſtinct.

2. If any Object be in the Focus of a Convex Glaſs, and the Eye in the oppoſite Focus on the other Side, it will appear under the ſame Angle, as if the Eye were in the Place of the Glaſs; and conſequently the Diſtance being double in that Poſition of the Eye and Object, it will appear through the Glaſs magnified under an Angle almoſt double of what it would appear to the naked Eye; but the Eye can ſee no more of its Area than the Breadth of the Glaſs will permit.

Mr. *Molyneux*, in his *Dioptrica Nova*, ſhews how to determine the viſible Area of an Object in the Focus of a Convex Glaſs from the Diſtance of the Object, and of the Eye from the Glaſs, and the Glaſs's Breadth. *P.* 126. *Prop.* 34.

3. If an Object be further from a Convex Glaſs than the Focus, and the Eye on the other Side be nearer than the diſtinct Baſe of the Glaſs, it will ſee the Object erect, but confuſed; and it will be moſt confuſed when the Eye is placed in the diſtinct Baſe.

4. But if the Object being placed as before, the Eye be farther from the Glaſs than a diſtinct Baſe, it begins to ſee the Object inverted, and at a due Diſtance diſtinct.

5. If the Object be nearer than the Focus, it will appear erect and diſtinct to an Eye placed on the other Side the Glaſs, at any Diſtance within the Eye's Power to diſcern it.

CONVEYANCE [in *Law*] a Deed or Inſtrument by which Lands, *&c.* are conveyed or made over by the Proprietor or Owner thereof, to ſome other Perſon.

CONVICT [*Convictus, L.*] in the *Common Law*, is he that is found guilty of an Offence by the Verdict of a Jury: But *Crompton* ſays, that Conviction is either when a Man is out-lawed, or appeareth and confeſſeth, or elſe is found guilty by the Inqueſt.

CONVOCATION, is commonly taken for the General Aſſembly of the Clergy, to conſult of Eccleſiaſtical Matters in Parliament; and as there are two Houſes of Parliament, ſo there are two Places called *Convocation Houſes*, the one called *The Higher*, where the Archbiſhop and Biſhops ſit ſeverally by themſelves; the other, *The Lower Convocation Houſe*, where all the reſt of the Clergy ſit.

An *Engliſh Convocation*, or *Synod*, as it now ſtands for the Province of *Canterbury*, conſiſts of a Preſident, the Lord Archbiſhop, and 21 Biſhops, 22 Deans, 53 Archdeacons, 24 Proctors of Chapters, 44 Proctors for the Dioceſan Clergy (2 for each Dioceſe) and one Præcentor. *Cowell's Interpreter. L.*

CONVOLUTION, is a winding or turning Motion which is proper to the Trunks of ſome Plants, as the *Convolvulæ* or *Bindweeds*, and to the Claſpers of Vines and of Briony; and Dr. *Grew* thinks that all thoſe Plants whoſe Roots are twiſted, have ſuch a Convolution; and he aſſigns two great efficient Cauſes of this winding Motion, the *Sun* and the *Moon*: Methinks 'twere worth the while, as 'tis very eaſy, to try whether there be any ſuch Convolution or not in the Trunks of Plants, which may eaſily be done, as he hints, by tying a little Bit of Paper to any of the Branches which are exactly *South*, *North*, *&c.* and then ſeeing whether it will change its Poſition or not, in reſpect of the Point of the Compaſs. *L.*

CONVOLVULUS. See *Iliack Paſſion. L.*

CONUS *Fuſorius*, is a ſort of Crucible made to melt Iron, or any other Metal. *L. Blanchard.*

CONUSANCE, the ſame with *Cogniſance*.

CONUSANT [in the *Common Law*] ſignifies Knowing or Underſtanding; as if the Son be *Conuſant*, and agrees to the Feoffment. *Cook* upon *Littleton.* Fol. 159. *b.*

CONVULSION, is a Motion whereby the Nerves, Muſcles, and Members, are contracted or remitted againſt the Will, or without it, as in the *Cramp. Epilepſy*, &c. *Blanchard.*

CONVULSIVE *Motions*, are ſudden and ſwift Concuſſions or Shakings that ceaſe and return alternately.

COOK-*Room* [in a *Ship*] is variouſly ſeated; in ſome, and generally (in great Ships) it is in the Fore-caſtle; and in ſome other Ships it is ſeated in the Hatch-way, upon the firſt Orlope; and for Ships of War (which are termed Men of War) it might moſt properly be there, in regard of Danger by Fire, and the freer Uſe of the Guns that lie in the Fore-caſtle, eſpecially if this *Cook-Room* (as ſome conceive) may be contrived to be moveable, and ſo in a Fight be ſtruck down into the Hold of the Ship. But after all, I cannot apprehend how it can be otherwiſe placed than in the Fore-caſtle, in great Ships, by reaſon of the Multitude of Men, which require, neceſſarily, the dreſſing of much Meat, and as neceſſarily a large and private Room to dreſs it in.

COPERCENERS, or *Parceners* [in *Common Law*] are ſuch as have equal Portions in the Inheritance of their Anceſtors; and as *Littleton* in the Beginning of the third Book, ſaith, *Parceners* be either by Law or by Cuſtom; *Parceners by Law* are the Iſſue Female which (no Heir-Male being) come in Equality to the Lands of their Anceſtors. *Parceners by Cuſtom*, are thoſe that by Cuſtom of the Country challenge equal Part in ſuch Lands; as in *Kent*, by the Cuſtom called *Gavel kind*: This, amongſt the *Feudiſts*, is called *Adæquatio.*

COPERNICAN *Syſtem*, the ſame with the moſt ancient, or *Pythagorean* Syſtem of the World, which *Copernicus* revived; and it is ſince improved, and now generally adhered to by Aſtronomers, and is as follows.

1. The Sun is ſuppoſed to be placed in the Middle, very near the Centre of Gravity of the entire Syſtem, in the common Focus of every one of the Planetary Orbits.

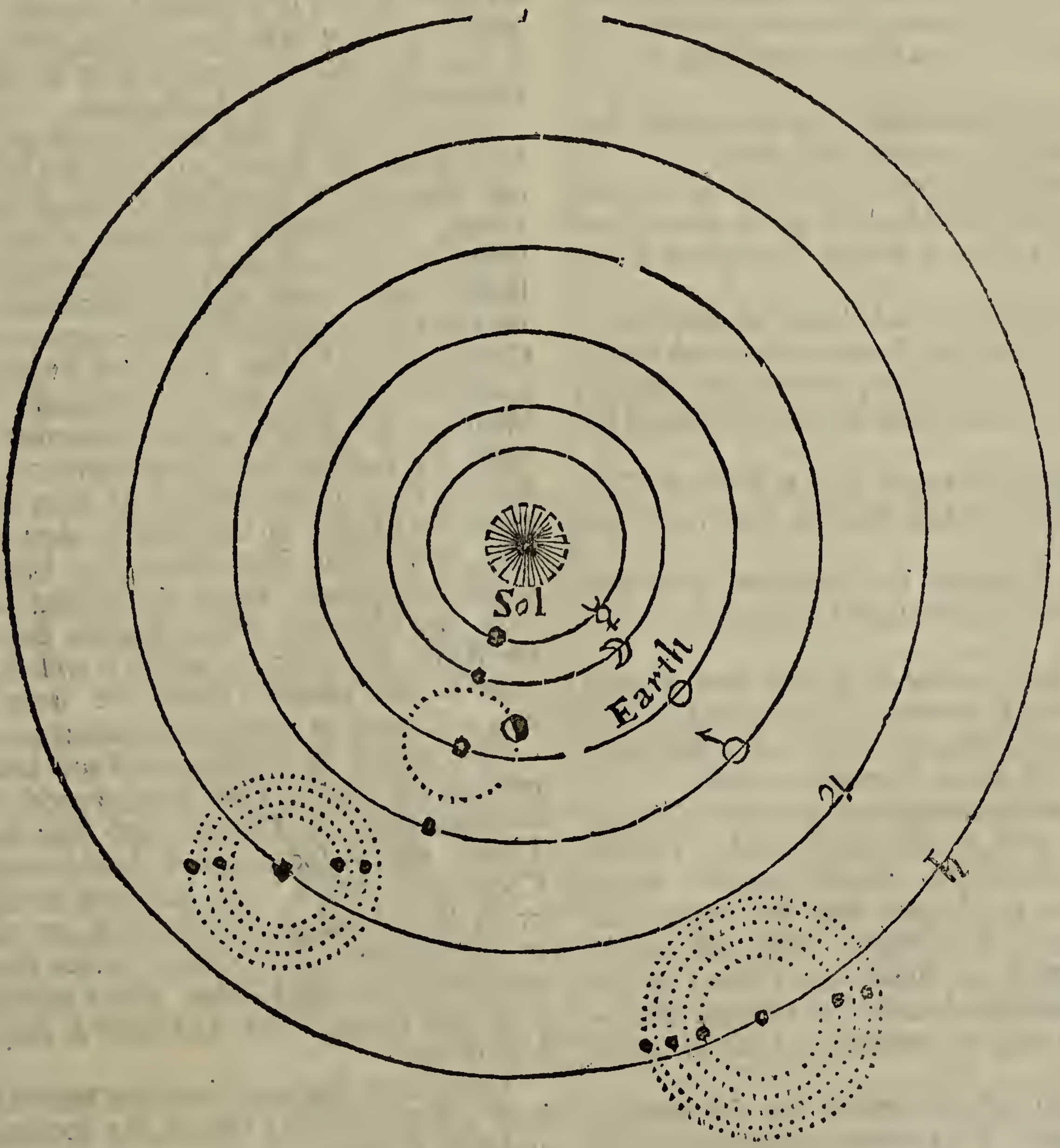
Next to him, *Mercury*, in about three Months Time, deſcribes his Ellipſis, and that ſo near, that we on the Earth rarely obtain a diſtinct View of him.

Next to *Mercury* is the Elliptick Orbit of *Venus*, whoſe Period is 7½ Months; and next to *Venus*, our Earth, with its Attendant the Moon, perform a joint Courſe, and meaſure out the Annual Period.

Next to the Earth, *Mars* alone, without any viſible Guard or Satellite accompanying him, revolves about the ſame Centre in about two Years Time.

Next to *Mars*, tho' at a mighty Diſtance from him, the largeſt of the Planets, *Jupiter*, with his four remarkable Satellites, takes his Round in 12 Years.

And laſtly, *Saturn* with his five little Moons about him, according to *Caſſini*, deſcribes, in 30 Years Time, the fartheſt and moſt remote Orbit; and completes the intire Planetary Chorus, as the Figure repreſents.



Beſides the Planets whoſe Orbits are not very different from Circles, there are another Species of Bodies which are called *Comets*, revolving about the Sun, in ſuch Ellipſes as may paſs almoſt for Parabola's, they are ſo exceeding excentrical; but as regularly retaining their ſeveral Periods and Orbits, as the Planets themſelves: Of which, ſee *Comets*.

COPHOSIS [Κώφωσις, *Gr.*] is a Deafneſs in the Ears. *Blanchard.*

COPIA *Libelli deliberando*, is a Writ that lieth, in Caſe when a Man cannot get the Copy of a Libel at the Hands of a Judge Eccleſiaſtical.

COPING *of a Wall* [in *Architecture*] the Top or Cover of a Wall, made ſloping, to carry off the Wet.

COPING *over* [in *Carpentry*] a Term uſed for a Hanging-over not ſquare to its Upright; but bevelling on its Under-ſide, till it end in an Edge.

COPOS [Κόπος, *Gr.*] is a Wearineſs of the Body, when the Muſcles, or their Fibres rather, are loaden and obſtructed with ſuch viſcous Humours, that they are rendred unfit for Motion. *Blanchard.*

COPPEL, or *Copple.* See *Cuppel.*

COPPERAS. The way of making Copperas, is as follows: Copperas Stones, which ſome call Gold Stones, are found on the Sea-ſhore in *Eſſex*, *Hampſhire*, and ſo Weſtward. There are great Quantities in the Cliffs, but not ſo good as thoſe on the Shore, where the Tides ebb and flow over them.

The beſt of them are of a bright, ſhining Silver Colour; the next, ſuch as are of a ruſty, deep Yellow; the worſt are ſuch as have Gravel and Dirt in them, of a ſadder Umber Colour.

In the midſt of theſe Stones are ſometimes found the Shells of Cockles, and other ſmall Shell-fiſhes; ſmall Pieces of the Planks of Ships, and Pieces of Sea Coal.

In order to the making of Copperas, they make Beds according as the Ground will permit; thoſe at *Deptford* are about 100 Foot long, and 15 Foot broad at the Top, and 12 Foot deep, ſhelving all the way to the Bottom.

They ram the Bed very well, firſt with ſtrong Clay, and then with the Rubbiſh of Chalk, whereby the Liquor which drains out of the Diſſolution of the Stones, is conveyed into a Wooden ſhallow Trough, laid in the Middle of the Bed, and covered with a Board; being alſo boarded on all Sides, and laid lower at one End than the other, whereby the Liquor is conveyed into a Ciſtern under the Boiling-Houſe.

When the Beds are indifferently well dried, they lay on the Stones about two Foot thick.

Theſe Stones will be five or ſix Years before they yield any conſiderable Quantity of Liquor; and before that, the Liquor which they yield is but weak.

They ripen by the Sun and Rain; yet Experience proves, that watering the Stones, altho' with Water prepared by lying in the Sun, and poured through very ſmall Holes of a Watering-pot, doth retard the Work.

In time, theſe Stones turn into a kind of Vitriolick Earth, which would ſwell and ferment like leavened Dough.

When the Bed is come to Perfection, then once in four Years they refreſh it, by laying new Stones on the Top.

When they make a new Bed, they take a good Quantity of the old fermented Earth, and mingle it with new Stones, whereby the Work is haſtened. Thus the old Earth never becomes uſeleſs.

The Ciſtern before mentioned, is made of ſtrong Oaken Boards, well joined and calked. That at *Deptford*, will contain 700 Tun of Liquor. Great Care is taken that the Liquor doth not drain thro' the Beds, or out of the Ciſtern. The beſt way to prevent the ſame, is, to divide the Ciſtern in the Middle, by Oaken Boards calked as before; whereby one of them may be mended in Caſe of a Defect.

The more Rain falls, the more, but the weaker, will be the Liquor: The Goodneſs whereof is tried by Weights prepared for that Purpoſe. Fourteen-penny Weight is rich; or an Egg being put into the Liquor, the higher it ſwims above the Liquor, the ſtronger it is. Sometimes the Egg will ſwim near half above the Liquor.

Within one Minute after an Egg is put in, the ambient Liquor will boil and froth; and in three Minutes, the Shell will be quite worn off.

A Drop of this Liquor falling on the Manufactures of Hemp, Flax, or Cotton-Wooll, will preſently burn a Hole thro' it. As alſo in Woollen and Leather.

Out of the aforeſaid Ciſtern the Liquor is pumped into a Boiler of Lead, about 8 Foot Square, containing about 12 Tuns, which is thus ordered: 1ſt, They lay long Pieces of Caſt-Iron, 12 Inches Square, as long as the Breadth of the Boiler, about 12 Inches one from another, and 24 Inches above the Surface of the Fire. Then croſs-ways, they lay ordinary flat Iron Bars as cloſe as they can lie, the Sides being made up with Brick-work. In the Middle of the Bottom of this Boiler is laid a Trough of Lead, wherein they put at firſt 100 Pound Weight of old Iron.

The Fewel for boiling, is *Newcaſtle* Coals. By Degrees, in the boiling, they put in more Iron, amounting in all to 1500 Pound Weight, in a boiling. As the Liquor waſtes in boiling, they pump in freſh Liquor into the Boiler: Whereby, and by a Defect in ordering the Fire, they were wont to be above 20 Days before it was enough; when that is, they try, by taking up a ſmall Quantity of Liquor into a ſhallow Earthen Pan, and obſerving how ſoon it will gather and cruſt about the Sides thereof. But now, of late, by the ingenious Contrivance of Sir *Nicholas Criſp*, the Work is much facilitated: For at his Work at *Deptford*, they boil off three Boilers of ordinary Liquor in one Week; which is done, firſt, by ordering the Furnace ſo, as that the Heat is conveyed to all Parts of the Bottom and Sides of the Furnace.

Then, whereas they were wont to pump cold Liquor into the Boiler, to ſupply the Waſte in boiling, whereby the Boiler was checked ſometimes 10 Hours, Sir *Nicholas* hath now a Veſſel of Lead, which he calls a Heater, placed at the End of the Boiler, and a little higher, ſupported by Bars of Iron as before, and filled with Liquor, which, by a Conveyance of Heat from the Furnace, is kept near boiling-hot; and ſo continually ſupplies the Waſte of the Boiler, without hindering the boiling. 3dly, By putting due Proportions of Iron, from time to time, in the Boiler; as ſoon as they perceive the Liquor to boil ſlowly, they put in more Iron, which will ſoon quicken it. Beſides, if they do not continually ſupply the boiling Liquor with Iron, the Copperas will gather to the Bottom of the Boiler, and melt it; and ſo it will do if the Liquor be not preſently drawn off from the Boiler into a Cooler, ſo ſoon as it is enough.

The cooler is oblong, 20 Foot long, 9 Foot over at the Top, 5 Foot deep, taper'd towards the Bottom, made of Terras. Into this they let the Liquor run ſo ſoon as it is boil'd enough. The Copperas herein will be gathering or ſhooting 14 or 15 Days, and gathers as much on the Sides as in the Bottom; *ſc.* above 5 Inches thick. Some put Buſhes into the Cooler, about which the Copperas will gather: But at *Deptford* they make no Uſe of any.

That which ſticks to the Sides and to the Buſhes, is of a bright Green; that in the Bottom, of a foul and dirty Colour.

In the End of 14 Days, they convey the Liquor into another Cooler, and reſerve it to be boiled again with new Liquor.

The Copperas they ſhovel on a Floor adjoining: So that the Liquor may drain from it into a Cooler.

The Steam which comes from the boiling, is of an Acrimonious Smell.

Copperas may be boiled without Iron, but with Difficulty; without it the Boiler will be in danger of melting.

Sometimes, in ſtirring the Earth upon the Beds, they find Pieces of Copperas produc'd by lying in the Sun.

COPROCRITICA, [of Κόπρος, *Gr.* Dung, and *Secretus* of *Secerno*, *L.* to ſeparate, *&c.*] are Medicines which purge away the Excrement in the Guts. *Blanchard.*

COPULA, [in *Logick*] is the Verb that connects any two Terms in an affirmative or negative Propoſition; as God is Good, where (*is*) is the Copula; Riches alone *make* not a Man happy, where (*make*) is the Copula. *L.*

COPULATIVE *Propoſitions*, are thoſe that include ſeveral Subjects or ſeveral Attributes joined together by an affirmative or negative Conjunction; that is to ſay, *and* (*not*) or (*neither:*) For (*neither*) does the ſame thing as (*and*) in theſe Sorts of Propoſitions, for that (*neither*) ſignifies (*and*) with a Negative, which falls upon the Verb, and not upon the Union of the two Words which it joins; as if I ſhould ſay, *That Knowledge and Riches don't make a Man happy:* Here I unite Knowledge and Riches, affirming of both that they don't make a Man happy.

COPY-HOLD, is a Tenure for which the Tenant hath nothing to ſhew but the Copy of the Rolls made by the Steward of the Lord's Court; for the Steward, as he doth inroll and make Remembrances of all other Things done in the Lord's Court, ſo he doth alſo of ſuch Tenants as he admitteth into the Court, to any Parcel of Land or Tenement belonging to the Manor; and the Tranſcript of this is called *The Copy of the Court Roll*, which is all the Tenant taketh from him, and keeps as his own Evidence: This Tenure is called *A Baſe Tenure*, becauſe it holdeth at the Will of the Lord: It is wont to be called *Tenure in Villanage* by ſome, who alſo ſay, that Copy-hold is but a new Name, yet it is not ſimply at the Will of the Lord, but according to the Cuſtom of the Manor; ſo that if a Copy-holder break not the Cuſtom of the Manor, and thereby forfeit his Tenure, he ſeemeth not ſo much to ſtand at the Lord's Courteſy for his Right, that he may be diſplaced Hand over Head at his Pleaſure. Theſe Cuſtoms of Manors be infinite, varying in one Point or other almoſt in every ſeveral Manor.

Firſt, Some Copy-holds are finable at Will, and ſome certain: That which is finable at Will, the Lord taketh at his Pleaſure, but if it exceed two Years Revenue, the *Chancery*, *King's-Bench*, *Common-Pleas*, or *Exchequer*, may reduce them to Reaſon. That which is certain, is a Kind of Inheritance, and called in many Places *cuſtomary*, becauſe the Tenant dying, and the Hold being void, the next of Blood, paying the cuſtomary Fine, (as 2*s.* for an Acre, or ſuch like) may not be denied his Admiſſion.

Secondly, Some Copy-holders have, by Cuſtom, the Wood growing upon their own Land, which by Law they could not have.

Thirdly, Copy-holders, ſome be ſuch as hold by the Verge in ancient Demeſne; and although they hold by Copy, yet are in Account a Kind of Freeholders, for if ſuch a one commit Felony, the King hath *Annum, Diem & Vaſtum*, as in the Caſe of Free-hold. Some other hold by common Tenure, called *Mere Copy-hold*, and they committing Felony, their Land eſcheateth to the Lord of the Manor.

COR, the Heart, is a fleſhy fibrous Subſtance made up of ſeveral Muſcles and Tendons; it has two Auricles or Ears, and as many Ventricles: The Vena Cava, or great Vein, is faſten'd to the Right Auricle, and the Pulmonary Vein to the Left; the Pulmonary Artery is joined to the Right Ventricle, and the great Artery to the Left. It is cloathed with a little membranous Bag, called the *Pericardium*, wherewith it is joined to the Mediaſtinum, and the Diaphragm; its Baſis is upwards, and Point downwards, and it is placed in the Middle of the Cheſt amongſt the Lobes of the Lungs. Its Uſe is to receive and diſperſe the Blood to all Parts in the Body. The Baſe of the Heart is environed round with a Plexus of Veins and Arteries.

Our excellent Dr. *Lower* was the firſt that gave us the true mechanical Structure of the Heart, and a very good rational Account of its Action: He explains the Syſtole of the Heart, by the natural Method of muſcular Contraction; but in order to account for its Diaſtole, he hath recourſe to a certain unaccountable Motion of Reſtitution, which ſeems not to be ſo well grounded.

The Heart being a ſingle Muſcle without an Antagoniſt, appears to be of the Sphincter Kind; and *Borellus*, in his *Oeconomia Animalis*, computes the motive Power of a Man's Heart to be more than that of a Weight of 3000 lb. The Obſtacles to the Motion of the Blood through the Arteries, he judges equivalent to 18000 lb. *i. e.* ſix times as much as the Power of the Heart: He eſtimates the Power of the Elaſtick Coat of the Arteries at 45000 lb. whoſe adventitious Help to move the Blood being deducted, he leaves the Heart with a Force but of 3000 lb. to ſurmount a Reſiſtance of 135000 lb. that is, with one to move 45; and this mighty Power in the Heart he aſcribes to the Force of Percuſſion. Dr. *Drake*, in his Diſcourſe of the Motion of the Heart in *Phil. Tranſ.* N° 280, ſuppoſes that Reſpiration hath a great Influence to aſſiſt it; and that even the Syſtole or Conſtriction of the Heart is occaſioned in ſome Meaſure by the Help of the Diaphragm and intercoſtal Muſcles, by whoſe Means the Blood hath a Paſſage opened for it into the Lungs, which deny'd, would be an invincible Obſtacle: And he thinks alſo that the Syſtole is furthered by the Situation and Capacity of the Blood-Veſſels of the Lungs, in the ſeveral Times of the Elevation and Depreſſion of the Ribs; for by this means a Paſſage is opened to the Blood to flow from the Right Ventricle of the Heart to the Left thro' the Lungs, to which it could not otherwiſe paſs; and the Oppoſition which the Blood contained in that Ventricle, muſt otherwiſe have made to its Conſtriction, is taken off. And thus the Doctor, with great Probability, ſuppoſes the Syſtole of the Heart to be much facilitated by the Action of the Thorax: But he ſaith, that neither the Diaphragm nor intercoſtal Muſcles can contribute any thing towards the Diaſtole, the Cauſe of which, be it what it will, muſt be equal to that of the Heart, the intercoſtal Muſcles, and the Diaphragm, to all which it acts as an Antagoniſt, dilating the Heart, as they conſtrict or cloſe it. The Doctor thinks ſuch a Power or Cauſe is not to be found any where in an Animal Body, and therefore it muſt be ſought without it; and he concludes, that this Cauſe is the Weight of the incumbent Atmoſphere preſſing upon the Thorax and other Parts of the Body, which he proves from Mr. *Boyle's* Experiments upon Animals in Vacuo, where, as ſoon as the Preſſure of the incumbent Atmoſphere is removed, the intercoſtal Muſcles and Diaphragm are contracted, and the Ribs elevated in an Inſtant, and can't by any Power of the Will be made to ſubſide, till the Air is let in again to bear them forcibly down: And, as in the Elevation of the Coſtæ, the Blood is in a manner ſollicited by the Paſſage now opened for it to flow into the Lungs; ſo in the Depreſſion of them by the Subſiſtence of the Lungs, and the Contraction of the Blood Veſſels, (both which are conſequent thereupon) the Blood is forcibly driven, as it were by an Embolus, through the Pulmonary Vein into the Left Ventricle of the Heart; and that, together with the general Compreſſion of the whole Body, by the Weight of the Atmoſphere, which ſurrounds and gravitates upon the whole Surface of it, is that Power which cauſes the Blood to mount in the Veins, after the Force impreſſed upon it by the Heart is broken and ſpent, and which is ſufficient to force the Heart from its natural State to Dilatation. And thus by the Contraction of the Heart, (the proper Action of all Muſcles) and its Dilatation again this Way, is the Circulation of the Blood ſet forward and kept going on.

COR, is by the Botaniſts uſed to ſignify the inward, ſoft, pithy, and ſpongy Part of any Tree or Plant; which they call alſo *Medulla* and *Matrix Arboris*. *L.*

COR *Caroli*, an extraconſtellated Star in the Northern Hemiſphere, ſituated between the *Coma Berenices*, and *Urſa major*, ſo called in Honour of King *Charles*. *L.*

COR *Hydræ*, a fix'd Star of the firſt Magnitude in the Conſtellation of *Hydra*; its Longitude is 142 Deg. 49 Min. Latitude 22 Deg. 23 Min. *L.*

COR *Leonis*. See *Regulus* or *Baſilicus*. *L.*

CORACOBRACHIALIS, or *Coracobrachiæus*, [of κόραξ, a Raven, *Gr.* and *Brachium*, an Arm, *L.*] is a Muſcle ſo called from its Origination and Inſertion: It ariſes partly fleſhy, and partly tendinous, from the Extremity of the *Proceſſus Coracoides Scapulæ*, and in its Deſcent it becomes larger, ſtrictly adhering to the internal tendinous Beginning of the *Biceps*, and parts from it near its tendinous Inſertion at the Middle of the internal Part of the *Os Humeri*: Thro' this Muſcle paſſes a large Nerve, wherefore by ſome it is called *Perforatus*. When it acteth, the Arm is moved upwards, and turned ſomewhat obliquely outwards.

CORACOHYOIDES, [of κόραξ and εἶδος, *Gr.* Shape] are Muſcles which proceed from the Proceſs of the Shoulder Bone, called *Coracoides*, and go on as far as the Bone *Hyoides*; their Uſe is to move obliquely downward.

CORACOIDES, is the Proceſs of the Shoulder-blade, in Form of a Crow's Beak: It is placed in the upper Part of the Neck, and projects over the Head of the Bone of the Arm, ſerving to ſtrengthen the Articulation of the Shoulder, and gives Origin to one of the Muſcles of the Arm.

CORAM *non Judice*, is a Term in the Common Law, when a Cauſe is brought into a Court wherein the Judges have no Juriſdiction. *L.*

CORBEILS, [in *Fortification*] are little Baskets about a Foot and a half high, eight Inches broad at the Bottom, twelve at the Top; which being filled with Earth, are frequently ſet one againſt another upon the Parapet, or elſewhere, leaving certain Port-holes, from whence to fire upon the Enemy under Covert, without being ſeen by them.

CORBEL, CORBEIL, [in *Architecture*] the Repreſentation of a Basket, ſometimes on the Heads of the *Caryatides*; the Baſe or Tambour of the *Corinthian* Order, ſo named from its reſembling a Basket.

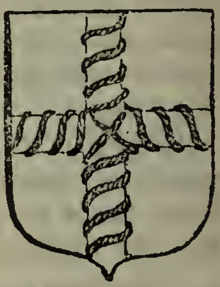
CORBEL, [in *Architecture*] is a ſhort Piece of Timber placed in a Wall, with its End ſticking out ſix or eight Inches, as occaſion ſerves. The under Part of the End thus ſticking out, is ſometimes cut into the Form of a Boultin, ſometimes of an O—G—, and ſometimes of a Face, *&c.* according to the Workman's Fancy; the upper Side being plain and flat. Theſe Corbels are uſually placed for Strength's Sake, immediately under the Semigirders of a Plat-form, and ſometimes under the Ends of Camber Beams; in which latter Caſe they are commonly placed a Foot or two below the Beam, and have a Piece of Timber ſtanding upright, cloſe to the Wall, from the Corbel to the Beam.

Corbels alſo is a Term uſed by ſome Architects, for the hollow Niches in Walls, which are left for Images, or Figures, or Statues to ſtand in.

CORD [in *Geometry*]. See *Chord*.

CORDAGE, at Sea, ſignifies in general, all the Ropes belonging to the Rigging of the Ship.

CORDED, [in *Heraldry*] as a Croſs corded, is a Croſs wound about with Cords, but ſo that the Cords do not hide all the Croſs, as in the Figure annexed.



CORDIALIA, are Medicines which are commonly thought to ſtrengthen the Heart; but they only put the Blood into a fine gentle Fermentation, which corroborates and facilitates the Motion of the Heart. *Blanchard.*

CORDON, [in *Fortification*] is a Row of Stones made round on the Outſide, and ſet between the Wall and the Fortreſs which lies in *Talus*, or a Slope, and the Parapet which ſtands perpendicular after ſuch a Manner, that this Difference may not be offenſive to the Sight; ſo that thoſe Cordons ſerve only as Ornaments ranging round about the Place; neither are they uſed but in Fortifications made of Maſon's Work, the void Space being filled up with pointed Stakes in thoſe that are raiſed with Earth.

CORDS, [in *Muſick*] properly ſignifies the Strings of a Harp, Violin, Lute, or any other muſical Inſtrument: But the Term is alſo applied to denote the Sounds which proceed from ſuch Inſtruments, even from thoſe that have no Strings.

CORINTHIAN *Order*, is reckoned by *Scamozzi* to be the fourth of the Five Orders of Architecture; but Mr. *Le Clerc* the fifth and laſt of them; it is the moſt noble, rich, and delicate of all the Five.

Vitruvius aſcribes it to *Callimachus*, a *Corinthian* Sculptor, who is ſaid to have taken the Hint by paſſing by the Tomb of a young Lady, over which a Basket with ſome of her Play-things had been placed by her Nurſe, and covered with a Tile, the whole having been placed over a Root of Acanthus; which, as it came up the Branches, encompaſſed the Basket, but arriving at the Tile, bent downwards under the Corners of it, forming a Kind of a Volute.

Hence *Callimachus* imitated the Basket by the Vaſe of his Column, the Tile in the Abacus of his Order, and the Leaves in the Volute.

But his Story of *Callimachus* is treated as a Fable by *Villapandus*, who imagines the *Corinthian* Capital to have taken its Original from an Order in the Temple of *Solomon*, whoſe Leaves were thoſe of the Palm-tree.

The *Corinthian* Order is diſtinguiſhed from the reſt by ſeveral Characters. The Capital is adorned with two Rows of Leaves, between which Caulicoles or little Stalks ariſe, of which the Volutes are formed, which are 16 in Number, and ſupport the Abacus.

It has not (properly ſpeaking) either Ovolo, or even Abacus; for indeed the Member that goes by that Name, is quite different from the Abacus in the other Orders, being cut with a Sweep, in the Middle of which a Roſe or ſome other Ornament is carv'd.

Vitruvius takes Notice, that the *Corinthian* Order has no particular Ordonance for its Cornice, or any the other Ornaments of its Entablature; nor does he himſelf give it any other Proportions than thoſe of the *Ionick* Order; ſo that if it appears higher than the *Ionick*, it is purely owing to the Exceſs of the Height of its Capital: He likewiſe makes the reſt of the Entablature the ſame, and uſes the *Attick* Baſe indifferently for the one and the other.

But there is a wide Difference, as to this Order, between *Vitruvius* and all the Examples of Antiquity now remaining; the moſt beautiful of which have a particular Baſe, and the whole Order 20 Modules high, whereas the *Ionick* has but 18.

Again, the Capital is higher than that of *Vitruvius* by one Third of a Module, and its Entablature, having Modilions, and ſometimes both Dentils and Modilions, is very different from the *Ionick* Entablature.

Vitruvius's Corinthian Ordonance is ſet aſide by modern Architects, who follow that of the ancient Buildings, from which they ſelect according to their ſeveral Taſtes; ſo that the modern *Corinthian* is rather a Kind of *Compoſite* Order, and differs from any of the antient Buildings, and much more from the Rules of *Vitruvius*.

Mr. *Perrault* makes the Height of the Shaft leſs than that of the *Ionick*, by reaſon of the Exceſs of its Capital.

Vignola and Mr. *Le Clerc* make the *Corinthian* Order 20 Modules high; but *Serlio* makes it but 18, and *Perrault* $18\frac{2}{3}$.

CORNACHINE *Powder*, the ſame with what is ſometimes called the *Earl of* Warwick*'s Powder*, and by foreign Writers frequently *Pulvis de tribus*; it is a purging Powder made of equal Parts of *Antimonium Diaphoreticum*, *Diagridium*, and *Cream of Tartar*.

CORNAGE [in our *Law*] ſignifies a Kind of grand Sergeantry; the Service of which Tenure is to blow a Horn, when an Invaſion of a Northern Enemy is perceived; and by this many hold Land in the Northern Parts about the Wall, *i. e.* the old *Picts* Wall.

CORNEA *Lunæ*. See *Luna Cornea*.

CORNEA *Oculi Tunica*, which is alſo called *Sclerotes*, and *Dura*, the hard Tunick, proceeds from a Tunick in the Brain called *Dura Meninx*; it is pellucid forwards, that it may tranſmit the viſible Species: Its Sides are covered with the Albugineous Tunick; inwardly it contains the Aqueous Humour.

The Figure of it is of a greater Convexity than the reſt of the Globe of the Eye; and it conſiſts of ſeveral Laminæ, which are nouriſhed by ſo ſmall Blood Veſſels, as to obſtruct very little of the Light; 'tis of a very exquiſite Senſe, that, on any light Touch, the Tears may be ſqueezed out of the Lachrymal Glands, to waſh it and clean it. *L.*

CORNICE [takes its Name of *Corona*, *L.* a *Crown*; *q. d.* a *Crowning*]. It is, in *Architecture*, the uppermoſt Member of the Entablature of a Column; or that which crowns the Order.

It is the third grand Diviſion of the Trabeation, which commences from the Freeze, and ends at the Cymatium.

There are as many kinds of Cornices as there are different Orders of Columns. As,

1. The *Tuſcan*, The whole Height of which Cornice, according to *Vitruvius*, is Half a Module, which Height being divided into four grand Diviſions, the uppermoſt of which goes to the Boultin and Fillet under it; and this Diviſion being again divided into four Parts, three of them go to the Boultin, and one to the Fillet.

The two next grand Diviſions go to the *Corona* (which is flat and plain) and the lowermoſt grand Diviſion goes to the Cymatium; which being again divided into three Parts, the uppermoſt of them goes to the Fillet, and the other two to the Cima, or O— G—

The Projecture of the whole Cornice (as alſo of each Member of it) he makes to be equal to its Height, and divides the Under-ſide of the *Corona* into eleven Parts, of which two are given to the Fillet, and one to the Dentil, and ſo alternately; for which he gives this Reaſon, That it is fit.

Scamozzi makes the whole Height of this Cornice 39 Minutes, and the Height of every particular Member of it, as follows: (beginning at the Top, and deſcending in Order).

The upper Liſt or Plinth of the Cornice, 3 *M.* the Supercilium Liſt, *Tinea*, $1\frac{1}{2}$ *M.* the upper Cima, or O— G—, 8 *M.* the Liſt under it, $\frac{1}{2}$ *M.* the *Corona*, $9\frac{3}{4}$, the Liſt $1\frac{1}{2}$ *M.* the Cima, or greater O— G—, 6 *M.* (here's $1\frac{1}{2}$ *M.* left betwixt, for the Depth of the Dentils) the Supercilium, or Liſt, $1\frac{1}{4}$, the Cimatium, or little O— G—, 5 *M.* the Liſt, 2.

Palladio makes the whole Height of this Cornice 44 Minutes, of which $3\frac{1}{2}$ *M.* go to the Liſt at the Top, and the *Cima Recta*, 10 *M.* the Liſt under it, $2\frac{1}{2}$ *M.* the *Corona*, 10 *M.* the Boultin, 9 *M.* and the Cavetto, or Hollow, $7\frac{1}{2}$ *M.*

2. The *Dorick* makes two different Faſhions of *Dorick* Cornices; the whole Height of the one is Half a Module; which being divided into two grand Diviſions, the uppermoſt of which is divided into 8 Parts, one of which goes to the Liſt at Top, and the other 7 to the O— G— The other grand Diviſion is ſubdivided into four Parts, the uppermoſt Parts of which go to the two Cymatiums, and the two middle Parts to the *Corona*, the Liſt of each of theſe Cymatiums is one Third of the whole Cymatium. As to the Cornice of the other Faſhion, it is 40 *M.* which divided into 9 Parts, two go to the two Facias, one to the Thorus or Boultine above them, and two to the Modilions above that, two to the *Corona*, and two to the *Cima*. The Modilions, as alſo the *Corona*, being divided each into three Parts, one of them ſhall go to each of their reſpective Cymatiums, the Liſts of which are each $\frac{1}{3}$ of the whole.

Scamozzi makes the Height of this Cornice 42 *M.* whoſe Liſt at the Top is 2 *M.* the great O— G—, 7 *M.* the Liſt, 1 *M.* the little O— G—, 3 *M.* the *Corona*, 8 Minutes, the Liſt, 1. the Caſement, 2 *M.* the Boultin, 5 *M.* the Liſt, 1. the Square 7 *M.* the Liſt, 1 *M.* and the Boultin, 4 *M.*

Palladio, in his verbal Deſcription of this Cornice, makes the whole Height of it to be 35 Minutes; but in his Figure, 'tis but $33\frac{1}{4}$, of which the Liſt at the Top is $2\frac{1}{2}$ *M.* the *Cima Recta*, or O— G—, $6\frac{3}{4}$; the Liſt, 1 *M.* the *Cima Reverſa*, $3\frac{1}{4}$ *M.* the *Corona*, 8 *M.* the Ovolo or Boultine, 6

M. the Liſt, 1 *M.* and the Caſement at the Bottom, 5 *M.*

3. The *Ionick* Cornice. *Vitruvius* makes the whole Height of this Cornice about $52\frac{1}{2}$ *M.* He alſo deſcribes Cornices of two Faſhions in this Order: He divides the whole Height of the one into 11 Parts, the two uppermoſt of which go to the Cymatium, and the Boultin under it. This Space is ſubdivided again into 6 Parts, two of which go to the Fillet of the Cymatium, three to the O—G—, and one to the Boultin. The next two grand Diviſions go to the *Corona*; the next three grand Diviſions, to the *Cartouſes* and the *Cymatium* over them: And this Space is again divided into 5 Parts, one of which makes the *Cymatium*, of which the *Fillet* is one Third of the whole; then $1\frac{1}{2}$ of the next grand Diviſion goes to the *Caſement* and the *Fillet* over it, of which the *Fillet* is $\frac{1}{4}$ of the whole; and the laſt grand Diviſion goes to the *Cymatium* of which the Fillet is one Third-part of the whole.

The *Cornice* of the other Faſhion he makes thus: He divides the whole Height into 6 Parts, the uppermoſt of which goes to the O—G—, $\frac{1}{6}$ of which goes to the *Fillet*. Again, the next grand Diviſion he divides into three Parts, the uppermoſt of which goes to the *Cymatium* (the Fillet of which is $\frac{1}{3}$ Part) and the other two go to the *Corona*. The next two grand Diviſions are ſubdivided into five Parts, of which the uppermoſt goes to the *Cymatium* (the Fillet of which is $11\frac{1}{3}$ Part) and the other four go to the *Cartouſes*. The next grand Diviſion is again divided into four Parts, three of which go to the *Boultin*, and one to the *Fillet* under it. And the laſt grand Diviſion is ſubdivided into four Parts, three of which go to the *Caſement*, and one to the *Cymatium*, of which the Fillet is one Third-part.

Scamozzi makes the whole Height of this *Cornice* 42 *M.* of which the Liſt at the Top is 2 *M.* the *Cima Recta*, $5\frac{1}{2}$ *M.* the *Liſt*, 1 *M.* the *Cima Reverſa*, $2\frac{1}{2}$ *M.* the *Corona*, $6\frac{1}{2}$ *M.* the *Cima Reverſa*, $2\frac{1}{2}$ *M.* the *Cartouſes*, 7 *M.* the *Boultin*, 4 *M.* the *Liſt*, 1 *M.* the *Square*, 5 *M.* the *Liſt*, 1 *M.* and the *Boultin*, 4 *M.*

Palladio makes the whole Height of this *Cornice* $46\frac{1}{2}$ *M.* of which the Liſt at the Top is $2\frac{1}{2}$ *M.* the *Cima Recta*, 7 *M.* the *Liſt*, $1\frac{1}{4}$ *M.* the *Cima Reverſa*, $3\frac{1}{3}$ *M.* the *Corona*, 8 *M.* the *Cima Recta* over the Modillions, $3\frac{1}{4}$ *M.* the *Modillions*, $7\frac{1}{2}$ *M.* the *Liſt*, 1 *M.* the *Ovolo* or *Boultin*, 6 *M.* the *Liſt*, $1\frac{1}{2}$ *M.* and the *Cavetto* or *Hollow*, 5 *M.*

4. *Corinthian* Cornice. *Vitruvius* makes the whole Height of this Cornice one Module. He alſo deſcribes two different Faſhions in this Cornice: In one of which the whole Height is divided into five Parts, the uppermoſt of which goes the O—G—, the Fillet of which is $\frac{1}{6}$ Part; then $1\frac{1}{4}$ of the next grand Diviſion, goes to the *Corona* and *Cymatium* over it; of which Space, the *Cymatium* is one Third-part, and its Fillet one Third of that. Of the next grand Diviſions, $1\frac{3}{4}$ goes to the *Modillions* and *Cymatiums* over them; of which Space the *Cymatium* is $\frac{1}{7}$ Part. And the laſt grand Diviſion goes to the *Boultin*, and Fillets over and under it; which being divided into three Parts, the lowermoſt goes to the *Fillet*; and the other two being again divided into ſix Parts, five of them go to the *Boultin*, and the other to the Fillet over it.

In the *Cornice* of the other Faſhion, he divides the whole Height into nine Parts, the two uppermoſt of which being divided into four Parts, three of them go to the O—G— (the Fillet of which is $\frac{1}{6}$ of the whole) and the other to the *Cymatium* over the *Corona* (the Fillet of which is $\frac{1}{3}$ of the whole) the next two grand Diviſions go to the *Modillions* and the *Cymatiums* over them, $\frac{1}{4}$ of this Space goes to the *Cymatium* (the Fillet of which is one Third of the whole *Cymatium*) and the reſt to the Modillions. The next two grand Diviſions go to the *Boultin*, and Fillet over and under it; which Fillets are each $\frac{1}{7}$ of the whole. And the laſt grand Diviſion goes to the *Cima* at the Foot of the Cornice.

Scamozzi makes the whole Height of this Cornice $46\frac{3}{4}$ *M.* of which the Liſt of the *Cima Recta* is 2 *M.* the *Cima Recta*, $6\frac{1}{2}$; the Liſt of the *Cima Reverſa*, 1 *M.* the *Cima Reverſa*, $3\frac{1}{4}$; the Half-round, $1\frac{1}{2}$; the *Corona*, $7\frac{1}{2}$; the *Cymatium*, $3\frac{1}{2}$ *M.* the *Modillions*, $8\frac{1}{2}$ *M.* the *Liſt*, 1 *M.* the *Boultin*, 5 *M.* the *Liſt*, 1 *M.* and *Cima*, 5 *M.*

Palladio makes the Height of this Cornice 50 *M.* of which $2\frac{1}{3}$ *M.* goes to the Liſt of the *Cima Recta*; the *Cima Recta* is $8\frac{1}{3}$ *M.* the *Liſt*, $\frac{2}{3}$ *M.* the *Cima Reverſa*, 3 *M.* the *Corona*, $7\frac{1}{3}$ *M*, the Liſt of the O— G— over the *Modillions*, $\frac{2}{3}$ *M.* the O— G— over the *Modillions*, $\frac{2}{3}$ *M.* the O— G—, $2\frac{2}{3}$ *M.* the *Boultin*, $4\frac{1}{3}$ *M.* the *Liſt*, 1 *M.* the *Boultin*, $5\frac{1}{2}$ *M.* the *Liſt*, 1 *M.* and O— G—, $4\frac{1}{2}$ *M.*

5. The *Compoſite* Cornice. *Vitruvius* makes the whole Height of this Cornice equal to the Diameter of the Column above, which is about $52\frac{1}{2}$ *M.* He alſo deſcribes two different faſhioned Cornices in this Order; one of which he divides into two Parts, the uppermoſt goes to the O—G— (whoſe *Fillet* is $\frac{1}{7}$ of the whole) and the undermoſt to the *Corona* and *Cymatium* over it; and this Space being divided into four Parts, three of them go to the *Corona*, and one to the *Cymatium*, whoſe Fillet is one Third of the whole *Cymatium*.

According to *Scamozzi*, the whole Height of this Cornice is 48 Minutes, and *Palladio* makes it 45 Minutes: But for the Height of each particular Member, they leave us very much in the Dark; for, according to either of them, the Sum of the Particulars will never make the whole Height; and beſides, *Palladio* ſets down no Dimenſions to ſeveral of the Members of this Cornice; ſo that a Perſon will be but little the wiſer for what any of theſe Authors ſay of this Cornice.

In brief, the *Tuſcan* Order is the moſt plain. *Vignola* makes it to conſiſt of an *Ovum*, or Quarter-Round; an Aſtragal or Baguette; the Reglet or Fillet; the Larmier, and the Talon.

In the *Dorick*, he makes Capitals of the Triglyphs of the Freeze, with their *Bandilettes*, a *Talon*, *Mutules*, or *Dentils*, a *Larmier* with its *Guttæ* underneath, a Talon, Fillet, Cavetto, and Reglet.

In the *Ionick*, the Members are, in moſt Reſpects, the ſame as in the *Dorick*; except that they are frequently enriched with Carving, and are always Dentils.

The *Corinthian* Cornice is the richeſt, and is diſtinguiſhed by having both Modillions and Dentils.

The *Compoſite* Cornice has no Dentils; its Mouldings are carved, and there are Channels under the Soffit.

CORNICE [with *Workmen*] is uſed, in the general, for all little Projectures of Maſonry or Joinery, even where there are no Columns; as, the Cornice of a Chimney, a Bouffet, *&c.* and is frequently uſed for the Crownings of Pedeſtals.

Architrave CORNICE, is one immediately contiguous to the Architrave, the Freeze being retrenched.

Mutilated CORNICE, is one whoſe Projecture is cut or interrupted, to the Right of the Larmier, or reduced into Platband, with a Cimaiſe.

Cantaliver CORNICE, a Cornice that has Cantalivers under it.

Modillion CORNICE, one with Modillions under it.

Coving CORNICE, one which has a great Caſement, or Hollow in it, ordinarily lathed and plaiſter'd upon Compaſs Sprockets, or Brackets.

CORNICULARIS *Proceſſus*. See *Ancer oides*.

CORNICULATE *Plants* and *Herbs*, are ſuch as after each Flower produce many diſtinct and horned Seed-pods; which Seed-veſſels are called *Siliquæ*: This Kind is called alſo *Multiſiliquous*; ſuch as the *Sedum* or *Sempervivum*, *Telephium*, *Sedum Stellatum*, *Juncus Floridus*, *Helleborus Niger*, *Fraxinella*, *Aconitum* (or *Napellus*) *Aquilegia*, *Delphinium*, *Pæonia*, *Caltha Paluſtris*, *Althæa Lutea*, &c.

CORNISH *Ring of a Gun*, is the next from the Muzzle Ring backwards. See *Ordnance*.

CORNUA *Uteri*, are two lateral Parts of the Womb in ſome Brutes, as Cows, Harts, Sheep, Goats, *&c.* yet ſome Authors have attributed the ſame Parts to a Woman's Womb, from ſomething which imitates them there; for at the Sides of the Bottom of the Womb, there is a Sort of Protuberance on both Sides, where the *Vaſa Deferentia* are inſerted; yet a Woman's Womb is rarely Bipartite, as it is in Brutes. *L.*

CORODIO *Habendo*, is a Writ whereby to exact a Corody of an Abbey or Religious Houſe.

CORODY *Habendo*, [in *Common Law*] ſignifies a Sum of Money, or Allowance of Meat, Drink, and Cloathing, due to the King from an Abbey, or other Houſe of Religion, whereof he is Founder, towards the reaſonable Suſtenance of ſuch a one of his Servants, being put to his Penſion, as he thinketh good to beſtow it on. And the Difference between a Corody and a Penſion ſeems to be, that a Corody is allowed towards the Maintenance of any of the King's Servants that liveth in an Abbey; a Penſion is given to one of the King's Chaplains, for his better Maintenance in the King's Service, until he may be better provided of a Benefice. It appears in *Weſt.* 2. *Cap.* 25. that an Aſſize ſhall lie for a Corody; and in others, that Corodies belonged ſometimes to Biſhops from Monaſteries; and alſo, that a Corody may be due to a common Perſon, by Grant from one to another, or of common Right, to him that is a Founder of a Religious Houſe, not holden in *Franc-Almoine*, for that Tenure was diſcharged of all Corodies in itſelf. And a Corody is ſaid to be either certain or uncertain, and that it may be for Life, for Years in Tail, or in Fee.

COROLLARY [*Corollarium*, *L.*] or *Conſectary*, is an uſeful Conſequence drawn from ſomething which hath been already advanced or demonſtrated; as if from this, *viz.* *That a Triangle which has two equal Sides, has alſo two Angles equal*; you ſhall draw this Conſequence, *That a Triangle which has the three Sides equal, has alſo its three Angles equal.*

CORONA, [in *Anatomy*] is that Edge of the Glands of the Penis, where the Præputium begins.

CORONA, CORONIS, [in *Architecture*] is properly the flat and moſt advanced Part of a Cornice, called by the *French Larmier*, and by us *the Drip*, becauſe it defends the reſt of the Work from Wind and Weather; but it is often taken by *Vitruvius* for the whole Cornice.

Corona, or the Flat-Crown, is alſo a particular Member in the *Dorick* Gate, made by ſo extraordinary an Enlargement of the *Larmier* or *Drip*, that it hath ſix Times more Breadth than Projecture. This Sort of Corona is no where found amongſt the Ancients, except only in the Writings of *Vitruvius*.

CORONA *Borealis*, *Northern Crown*, [in *Aſtronomy*] a Conſtellation of the Northern Hemiſphere.

The Stars in the Conſtellation of the Northern Crown, in *Ptolemey*'s Catalogue are 8, in *Tycho*'s as many, in the *Britannick* Catalogue 21.

CORONA *Meridionalis*, a Southern Conſtellation conſiſting of 13 Stars.

CORONALE. See *Frontis*.

CORONALIS *Sutura*, is a Cleft in the Head made like a Comb, and joins as if the Teeth of two Saws were cloſely compacted into one another: It is placed in the upper Part of the Skull from one Temple to another, and is circumſcribed with the Bones of the Forehead, and that particularly called *Bregma*; in the Middle whereof the Suture, ſtiled *Sagittalis*, is terminated. *L.*

CORONARIA *Vaſa*, are the Veins and Arteries which ſurround the Heart to nouriſh it: They ariſe out of the Aorta before it comes out of the Pericardium; they encompaſs the Baſis of the Heart like a Garland, and in their Circuit ſend down divers Twigs length-ways of the Heart, and when they have encompaſſed the Baſis and meet, they inoſculate with one another, but not with the Veins. *L.*

CORONATORE *Eligendo*, is a Writ which, after the Death or Diſcharge of any Coroner, is directed to the Sheriff out of the *Chancery*, to call together the Freeholders of the County for the Choice of another Coroner; and to certify into the *Chancery* both the Election and Name of the Party elected, and to give him his Oath. *L.*

CORONE, is an acute Proceſs of the lower Jawbone, from its Likeneſs to the Beak of a Raven, called *Roſtriformis*, in the Form of a Beak.

CORONER, is an ancient Officer of this Land, ſo called, becauſe he dealeth wholly for the King and Crown. There be four of them commonly in every County, and they are choſen by the Freeholders of the ſame upon Writ, and not by Patent. His Office eſpecially concerneth Pleas of the Crown. There be alſo certain ſpecial Coroners within divers Liberties, as well as thoſe ordinary Officers in every County; as the Coroner of the Verge, which is a certain Compaſs about the King's Court: And there are certain Charters belonging to Colleges and other Corporations, whereby they are licenſed to appoint their Coroner within their own Precincts.

CORPORA *Cavernoſa Penis*, (by *D'Graaf* called *Nervoſa*, and by others *Nervea Spongioſa*) are two *Capſulæ* or oblong *Folliculi*, fenced every where without with a thick Membrane. They ſpring with two diſtinct Originals from the lower Side of the *Oſſa Pubis*, whence ſtretching forwards, they meet one another, leaving an Interſtice before their Conjunction, in which the *Urethra* is conveyed: Where they leave the *Oſſa Pubis* they are each covered with a Membrane, and afterwards joined to each other by the Intervention of a *Septum Intermedium*, which, the nearer it comes to the Glands, is the more diminiſhed. *L.*

CORPORA *Olivaria*. See *Olivaria Corpora*. *L.*

CORPORA *Pyramidalia*, are Protuberances of the under Part of the Brain; they are in Length of about an Inch; when the Blood hath diſcharged itſelf of the Seed into the Teſticles, it returns by the Veins, which riſing in ſeveral Branches from the Teſtes, tends towards the Abdomen in the Production of the Peritoneum, the ſame way the Arteries came down. In their Progreſs, their Branches frequently inoſculate and divide again, till they come near the Abdomen, and then they all unite in one Trunk; and therefore, becauſe of their Shape, are called *Corpora Pyramidalia*. *L.*

CORPORA *Striata*, are Protuberances upon the *Crura Medullæ Oblongatæ*.

CORPORAL, is an inferior Officer in a Foot Company, who hath charge over one of the Diviſions; places and relieves Centinels, and keeps good Order in the *Corps de Garde*: He receives the Word of the inferior Rounds that paſs by his *Corps de Garde*.

CORPORAL of a Ship, is an Officer that hath the Charge of ſetting the Watches and Centries, and relieving them; and who ſees that all the Soldiers and Sailors keep their Arms neat and clean; he teaches them alſo how to uſe them, and hath a Mate under him.

CORPORATION, is a Body Politick authoriſed by the King's Charter, being of Capacity to take and grant, having a Common Seal, *&c.* Theſe are conſtituted either by Preſcription, by Letters Patent, or by Act of Parliament, and are either Spiritual or Temporal. *L.*

CORPOREITY, the School Term for the Nature of a Body, as the Quality of that which is corporeal, or has a Body.

CORPORIFICATION, CORPORATION, [with *Chymiſts*] the Operation of recovering Spirits into the ſame Body, or at leaſt into a Body nearly the ſame with that they had before their Spiritualization.

CORPS *de Garde*, is a Poſt in an Army ſometimes under Covert, ſometimes in the open Air, to receive a Number of Men, who are relieved from time to time to watch in their Turns for the Security of ſome more conſiderable Poſt; and it often alſo is taken for the Men thus watching, who are called the *Corps de Garde*.

CORPUS *cum Cauſa*, is a Writ iſſuing out of the *Chancery*, to remove both the Body and the Record touching the Cauſe of any Man lying in Execution upon a Judgment for Debt, into the *King's-Bench*, *&c.* there to lie till he have ſatisfied the Judgment. *L.*

CORPUS *Calloſum*, is the upper Part or Covering of a Space made by the joining together of the Right and Left Side of the internal Subſtance of the Brain. This Space forms the three Ventricles or Foramen Ovale, and its Bottom is the internal Subſtance of the two Sides of the Cerebrum gathered as it were into two Bundles, and are called the *Crura* of the *Medulla Oblongata*. *L.*

CORPUS *Glanduloſum*, the ſame with the *Proſtata*.

CORPUSCLES, [*Corpuſcula*, *L.*] The admirable Sir *Iſaac Newton* ſhews a Way of gueſſing with great Accuracy, at the Sizes of the component Corpuſcles or Particles of which Bodies are conſtituted, in the 2d Book of his Opticks, *pag.* 3. See more of this under the Word *Colour* and *Particles*.

CORPUSCLES, [in *Natural Philoſophy*] ſignify the minute Parts or Particles, or phyſical Atoms of a Body; and by this Word is not meant Elementary Parts, nor the Hypoſtatical Principles of the Chymiſts, but ſuch Particles, whether of a ſimple or compounded Nature, whoſe Parts will not be diſſolved, disjoined, or diſſipated by ordinary Degrees of Heat.

And that Way of philoſophizing which endeavours to explain Things, and to give an Account of the Phænomena of Nature by the Motion, Figure, Reſt, Poſition, *&c.* of Corpuſcles or minute Particles of Matter, is by the Honourable Mr. *Boyle* called very properly the

CORPUSCULAR *Philoſophy*; which was ſo very ancient, that both before *Epicurus* and *Democritus*, and even before *Leucippus* taught in *Greece*, there was a *Phœnician* Philoſopher that explained natural Phænomena by the Motions and Affections of the minute Corpuſcles of Matter, as very old Writers inform us; and therefore this Kind of Philoſophy ſhould rather be called *Phœnician* than *Epicurean*.

The chief Principles of the Mechanical Hypotheſis or Corpuſcular Philoſophy, Mr. *Boyle* ſums up in theſe Particulars:

1. They ſuppoſe that there is but one Catholick or Univerſal Matter, which is an extended, impenetrable and diviſible Subſtance common to all Bodies, and capable of all Forms.

2. That this Matter, in order to form the vaſt Variety of natural Bodies, muſt have Motion in ſome or all its deſignable Parts; and that this Motion was given to Matter by God the Creator of all Things, and has all manner of Directions and Tendencies.

3. Matter muſt alſo actually be divided into Parts, and each of theſe primitive Particles, Fragments or Atoms of Matter muſt have its proper Magnitude or Size, as alſo its peculiar Figure or Shape.

4. They ſuppoſe alſo, that theſe differently ſiz'd and ſhap'd Particles may have as different Orders and Poſitions, Situations or Poſtures, from whence great Variety may ariſe in the Compoſition of Bodies.

CORRECTOR *of the Staple*, is a Clerk belonging to the Staple that writeth and recordeth the Bargains of Merchants made there.

CORRIDOR, [in *Fortification*] is the Covert-Way lying round about the whole Compaſs of the Fortifications of a Place, between the Outſide of the Moat and the Palliſado's.

CORRIDOR, [in *Architecture*] a Gallery or long Iſle round about a Building, leading to ſeveral Chambers at a Diſtance from each other.

CORRODENTIA: Corroding Things, are Things which eat up and conſume excreſcent Fleſh with their ſharp Particles. *Blanchard.*

CORROSIBILITY, is the Power of being corroded, eaten, or diſſolved by any corroſive Menſtruum or Liquor; and the Honourable Mr. *Boyle* reckons theſe Qualifications neceſſary to render any Body corroſible:

1. That it be furniſhed with Pores of ſuch a Bigneſs and Figure, that the Corpuſcles of the Menſtruum or Solvent may enter them, and yet not be much agitated in them, without alſo giving briſk Knocks or Shakes to the ſolid Parts which conſtitute the Pores or Cavities: For ſometimes, though the Pores of a Body may be large enough to let in ſome groſs Corpuſcles, yet if theſe, for want of Solidity or Rigidity, are too flexible, or are of an incongruous Figure to thoſe Pores, a Diſſolution may not enſue; as it happens when pure Spirit of Wine is in the Cold put upon Salt of Tartar;

or when *Aqua Fortis* is put upon powdered Sulphur.

2. That its conſiſtent Corpuſcles be of ſuch a Bulk and Solidity as doth not incapacitate them from being disjoined by the Action of the inſinuating Corpuſcles of the Menſtruum.

3. That the Coheſion of the Parts of the corrodible Body be not ſo ſtrict, as that they are not ſeparable by the Action of the Diſſolvent.

CORROSIO *Chymica*, is a Diſſolution of mixed Bodies by corroſive Menſtruums. *L.*

CORROSIVE *Medicine*, is one that has a Power of corroding, as Lime, *Lapis Infernalis*, and other Cauteries.

CORROSIVENESS, is the Quality that ſome Liquors, which are called *Menſtruums*, have of diſſolving or corroding Bodies.

And the Attributes or Qualifications which ſeem proper to render any Liquor corroſive, Mr. *Boyle*, in his mechanical Original of this Quality, reckons to be ſuch as theſe:

1. That the Menſtruum or diſſolving Liquor conſiſt of, or abound with ſuch Particles as are not too big to get in at the Pores or Commiſſures of the Body to be diſſolved; nor yet ſo ſmall, as readily to paſs thro' them, as the Rays of Light do thro' Glaſs; nor muſt they be unable, by reaſon of their great Slenderneſs and Flexibility, to disjoin the Parts they invade.

2. That theſe Corpuſcles be of a Shape fitting to inſinuate themſelves more or leſs into the Commiſſures or Pores of the Body, in order to diſſociate its ſolid Parts.

3. That theſe Particles have alſo a competent Degree of Solidity, in order to disjoin the Particles of the Body to be diſſolved: And this Solidity differs much from the Bulk of the Corpuſcles mentioned in the firſt Requiſite; for one Thing may be much more ſolid than another, tho' it have, as to Bulk, the ſame Dimenſions: Thus the Stalk of a Plant may be as big as a ſmall Iron or a Steel Rod, but the latter is much ſolider than the former.

4. That the Particles of the Menſtruum be agile, and advantaged for Motion, in reſpect of their Shape, or their Smallneſs, or their Fitneſs, to have their Action befriended by the Preſſure of the Atmoſphere, which may help to drive them into the Pores of Bodies, or by the Agitation which theſe intruding Particles may be fitted to receive in thoſe Pores by the Tranſcurſion of ſome ſubtle ætherial Matter.

CORROSION; the Art of gnawing away by little and little the Continuity of the Parts of Bodies. *L.*

CORRUGANT *Muſcles*, according to ſome, are thoſe that help to knit the Brows when one frowns; but they ſeem to be only a Part of the Frontal Muſcles that have their Fibres running in this Place ſomewhat obliquely.

CORRUGATOR *Supercilii*, is by ſome Anatomiſts reckoned as a Muſcle of the Eye-brows, helping to knit them when we frown; but it ſeems to be only a Part of the Frontal Muſcles, having Fibres in this Place a little oblique. *L.*

CORRUPTION, is the Deſtruction, Extinction, or, at leaſt, the Ceſſation, for a Time, of the proper Mode of Exiſtence of any natural Body: For whenever any body loſes all, or any of thoſe Accidents which are eſſentially neceſſary to the conſtituting it of ſuch a Kind, it is then ſaid to be corrupted or deſtroyed, and loſes its former Denomination, being not now a Body of the Kind it was before. But, as in Generation, nothing ſubſtantial is produced, ſo here nothing ſubſtantial is loſt or deſtroyed, but only that Modification of the Body which was its Form, and made it be of ſuch a Species.

CORRUPTION of Blood, [in *Law*] an Infection accruing to a Man's State, attainted of Felony and Treaſon, and to its Iſſue; ſo that his Iſſue cannot be Heirs to him, and any other Anceſtors by him, and if he be noble, his Heirs are rendered ignoble.

CORSNED, [in the *Saxon*] is *Ordeal Bread*; *Panis Conjuratus*: For the *Saxons* had a ſuperſtitious Way of purging themſelves of an Accuſation, by taking a Piece of Bread and eating it with ſolemn Oaths and Execrations, that it might prove their Poiſon, *&c.* if they were guilty; which way of ſpeaking is retained in ſome Places to this Day, eſpecially in *Kent*.

CORTICAL *Part of the Brain*, is the outward Subſtance of the Brain, full of Labyrinths and Meanders on the Outſide; it is covered with a thin Skin, and is of an Aſh-griſly Colour, being, as *Malpighius* ſaith, only an Heap of little oval Glands, and full of little Veſſels; inwardly the Medullary Subſtance is next to it. Its Uſe is thought by ſome to be for the generating Animal Spirits from the Blood, and hence they are conveyed by the Medullary Subſtance to the Nerves, and diſtributed through the whole Body: And the Seat of the Memory and Sleep is placed there by many Anatomiſts.

CORTIN, [in *Fortification*] ſignifies the Wall or Diſtance between the Flanks of two Baſtions.

CORUSCATION, or *Flaſhing*, is (by the *Carteſians*) an Exhalation ſpread under a Cloud, which ruſhing downwards is ſet on Fire and flaſheth. *L.*

CORVUS, a *Crow*, [in *Aſtronomy*] a Conſtellation of the Southern Hemiſphere.

The Stars in the Conſtellation Corvus, in *Ptolemy*'s Catalogue are 7, in *Tycho*'s as many, in the *Britannick* Catalogue 10.

CORVUS was a Machine invented by the *Romans*, in the Time of their Conqueſts of *Sicily*, when they firſt engaged the *Carthaginian* Fleet, and was framed, as *Polybius* deſcribes it, *Lib.* 1. after this manner.

On the Prow of their Ships, they erected a round Piece of Timber about 1 Foot in Diameter, and 12 Foot in Length, on the Top of which was a Block or Pulley; round this Piece of Timber was a Platform of Boards four Foot in Length, and about 18 Foot long, well framed and faſtened with Iron: The Entrance was long-ways, and it was moveable round the aforeſaid upright Piece of Timber, and could alſo be hoiſted up and down, within 6 Foot of the Top; about this Frame was a ſort of Parapet, Knee-high, which was defended with upright Bars of Iron, ſharp at the Ends, and towards the Top there was a Ring, by the Help of which, and a Pulley or Tackle, it was hoiſted and lowered at Pleaſure: With this moveable Gallery they boarded the Enemies Ships (when they did not lie Side by Side) ſometimes on their Bow, and ſometimes in the After-part of the Ship; the Soldiers keeping the Boſs of their Bucklers level with the Top of the Parapet, *&c.* and by the Means of this new Engine, got the Day of the *Carthaginians*, in their firſt Sea-fight with them, tho' the Enemy were long before well skill'd in Naval Affairs, and the *Romans* perfectly raw and unskill'd.

CORYMBUS, [κόρυμβος, *Gr.*] in general, ſignifies the Top of any thing; but among the old

Writers about Plants, Corymbi were the Bunches or Cluſters of Ivy Berries: Some alſo call the Top of the Stalk of a Plant, when 'tis ſo ſubdivided and adorned with Flowers or Fruits that it makes a round ſpherical Figure, by this Name Corymbus, as the Tops of Leeks, Onions, and of the *Sambucus Aquatica, &c.* and others confound the Word with Umbella, which expreſſes the flowery Top of ſuch Plants as have their Branches and Flowers ſpread round into the Form of what our Women now call an Umbrella. But among our modern Botaniſts it is uſed for a compounded diſcous Flower, whoſe Seeds are not pappous, or do not fly away in Down; ſuch are the Flowers of Daiſies, Corn-Marygold, *&c.* and therefore the accurate Botaniſt Mr. *Ray* makes one large Genus of Plants to be ſuch as have a compound diſcous Flower, but without any downy Wings to carry off their Seeds, and theſe he properly calls

Corymbiferous Plants: And theſe he diſtinguiſhes into,

1. Such as have a Radiate Flower, as the *Flos Solis, Calendula, Caltha, Flos Africanus, Chryſanthemum, Sagetum, Buthphalmum, Ptarmica, Abſinthium Umbelliferum, Millefolium, Bellis Major & Minor, Parthenium, Chamæmelum, &c.*

2. Such as have a naked Flower, as the *Abrotanum Fœmina, Eupatorium Cannabinum fœmina, Coſtus Hortorum, Ageratum, Abſinthium, Artemiſia, &c.*

To which he adds ſuch as he calls

Corymbiferis Affines; *i. e.* ſuch Plants as ſeem akin to the Corymbiferous kind; as *Scabioſa, Dipſacus, Carduus, Sphærocephalus, Eryngium, &c.*

CORYPHE [Κόρυφὴ, *Gr.*] is the Crown of the Head; alſo, the interior Extremity of the Fingers, near the Nails. *Blanch.*

CORYZA, or *Gravedo,* [Κορυζα, *Gr.*] is a Defluxion of a ſharp, ſalt, and thick Humour, into the Mouth, Lungs, and Noſtrils, from the Ventricles of the Brain, by the Olfactory Nerves; for when it grows thick, it can neither be percolated by the Reins, nor paſs from the Pituitary Glandule thro' the *Infundibilum,* into the Veins; and therefore it diſtils into the Noſtrils by the aforeſaid Nerves. *Blanchard.*

CO-SECANT, is the Secant of an Arch which is the Complement of another, to 90°.

CO-SINE, is the Right-Sine of an Arch, which is the Complement of another, to 90 Degrees.

COSENAGE, or *Cognatione,* is a Writ that lies where the Great-Grandfather is ſeized in his Demeſne, as of Fee, at the Day of his Death, of certain Lands and Tenements, and dieth, and then a Stranger entereth and abateth; for then ſhall his Heir have this *Writ of Coſenage.*

COSHERING [in the *Feudal Laws*]. As there were many Privileges inherent by Right and Cuſtom, ſo were there then ſeveral grievous Exactions impoſed by the Lords, by a ſort of Prerogative, or Seigniorial Authority, as to lie and feaſt themſelves and their Followers (called *Coſhering*) at their Tenants Houſes.

COSMETICKS [Κοσμέω, *Gr. to adorn*] are Medicines which whiten and ſoften the Skin, or, in general, any thing that helps to promote the external Beauty, or good Appearance of the Perſon that uſeth it.

COSMICAL [of Κοσμος, *Gr. the World*] a Term in *Aſtronomy,* expreſſing one of the Poetical Riſings of a Star; for a Star is ſaid to riſe coſmically, when it riſes together with the Sun, or with that Degree of the Ecliptick wherein the Sun then abides; and the Coſmical Setting, is, when a Star ſets and goes down in the Weſt, at the ſame time as the Sun riſes in the Eaſt.

COSMOLABE, an ancient Mathematical Inſtrument, ſerving to meaſure Diſtances both in the Heavens and the Earth.

COSMOGRAPHY [Κοσμογραφία, of κόσμος and γράφω, *Gr. to deſcribe*] is a Deſcription of all the ſeveral Parts of the viſible World, delineating them according to their Number, Poſitions, Motions, Magnitudes, Figures, and their other Properties. The two Parts of which are, Aſtronomy and Geography.

COSSE and *Coſſick,* the old Word for *Algebra.*

COST [in the Plural Number, *Cotizes*] a Term in *Heraldry,* ſignifying a Fourth-part of a *Bend.*

COSTÆ, the Ribs, are thoſe Bones which, with other Parts, make the Cheſt or Thorax; backward they are connected with the Vertebræ of the Back; forward, with the Cartilages of the Breaſt-Bone: They are Twelve in Number on each Side; the Seven upper are called *Coſtæ Veræ, True,* becauſe their cartilaginous Ends are received into the Sinus of the Sternum; the Five lower, *Spurious,* becauſe they are ſhorter and ſofter; the broader Part of the Rib is called *Palmula*; the ſtraighter, towards the Vertebræ, *Remulus.* The Ribs are crooked, like the Segments of Circles, and grow flat and broad as they approach the Sternum; but nearer the Vertebræ they are rounder and thicker, and at thoſe Ends have each a round Head, which being covered with a Cartilage, is received into the Sinus in the Body of each Vertebra; and at the Neck of each Head there is a ſmall Tubercle, which is alſo received into the Sinus of the Tranſverſe Proceſſes of the Vertebræ; and as they are thus articulated, the Ribs make an Acute-Angle with the lower Vertebra. Each one hath a ſmall Canal or Sinus running along the Under-ſide, in which lie a Nerve, Vein, and Artery: Their Extremities, which are faſtened to the Sternum, are cartilaginous, and the Cartilages make an Obtuſe-Angle with the Bony-Part of the Rib. Theſe Cartilages are harder in Women than Men, that they may the better ſuſtain the Weight of the Breaſts.

Dr. *Keil* obſerves very well in his Anatomy, P. 227, That if the Ribs had been articulated with the Bodies of the Vertebræ at Right-Angles, the Cavities of the Thorax could never have been enlarged in breathing: If each Rib had been a rigid Bone articulated at both Ends to two fix'd Points, the whole Cheſt had been immoveable. If the Ribs had not been articulated to the Tranſverſe Proceſſes of the Vertebræ, the Sternum could not have been thruſt out to that Degree it is now, nor the Cavity of the Thorax increaſed ſo much as is requiſite in Inſpiration; for when the Ribs are pulled up by the Intercoſtal Muſcles, the Angle which the Cartilages at the Sternum make with the Bony-Part of the Rib, muſt be increaſed, and conſequently its Subtenſe, or the Diſtance between the Sternum and the Tranſverſe Proceſſes, lengthened.

ened. Now, becauſe the Rib cannot move beyond the Tranſverſe Proceſs, on the Account of its being articulated with it ; therefore the Sternum muſt either be thruſt to the other Side, or elſe outwards : It cannot move to the other Side, becauſe of an equal Preſſure upon the ſame Account there ; and therefore 'tis thruſt outwards, or the Diſtance between the Sternum and the Vertebræ is increaſed : The laſt Ribs, which do not reach the Sternum, and conſequently conduce nothing to this Action, are not articulated with the Tranſverſe Proceſſes.

If we ſuppoſe the Cavity of the Thorax to be Half a Spheroid, whoſe Semi-axis is equal to the Height of the Thorax, or about 15 Inches, and the Diameter of its greateſt Circle 12 Inches, then the Cavity of the Thorax will contain about 1130 Cubick Inches ; but in an eaſy Inſpiration, the Sternum is raiſed $\frac{1}{10}$ of an Inch (as I am aſſured by an exact Experiment) ; and therefore, on that Account, the Thorax is enlarged to the Capacity of 1150 Cubick-Inches. To this, if we add the Space which the Diaphragm leaves, which is the Segment of a Sphere, whoſe Diameter is about 15 Inches, and the Solidity of that Segment 183 Inches, we ſhall have 22 Inches more, if the Diaphragm deſcends but one Inch ; but if it deſcends an Inch and a Half, it then leaves Room for 32 Inches of Air more to enter ; and if it deſcends 2 Inches, the Cavity of the Thorax will be increaſed on the Account of the Motion of the Diaphragm alone to 86 Inches ; ſo that in the leaſt Inſpiration which we can fairly ſuppoſe, the Lungs are diſtended with 42 Inches of Air, and ſometimes may receive above 70 or 100.

COTLAND is a Land held by a Cottager, whether in Soccage or Villenage.

CO-TANGENT, is the Tangent of an Arch, which is the Complement of another to 90 Degrees.

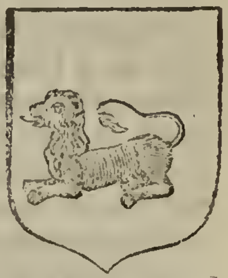
COTICE, COTISE [in *Heraldry*] ſo called of *Cote*, *F.* a Side, this being born as it were on the Sides of the Bend. It is the fourth Part of a Bend, which, with us, is ſeldom born but in Couples, with a Beaſt between them.

COTYLE [Κοτύλη, *Gr.*] the ſame with *Acetabulum*, is the Cavity of the Huckle-Bone, which is appointed to receive the Head of the Thigh-Bone.

COTYLEDON, the ſame with *Cotyle.*

COTYLEDONES [Κοτυληδόνες, *Gr.*] or *Acetabula Uterina*, are Glandules diſperſed up and down the uttermoſt Membrane, inveſting the *Fœtus*, called *Chorion*, which ſeparate the nutritious Juice from the Womb, to nouriſh the *Fœtus* ; but this is found only in ſome Animals ; the *Placenta* in the Womb ſupplies their Place in Women. The gaping meeting of the Veins in the Womb alſo are called *Cotyledones* and *Acetabula*. Theſe Glandules are ſo called from the Reſemblance they bear to the Leaves of the Herb *Pennywort*, in *Latin*, *Cotyledon.*

COUCH is a Term in *Painting*, ſignifying the Ground-Bed or Baſis, on which any Colour lies ; and is diſtinguiſh'd from the Field, which is always Horizontal, and upon the Flat ; whereas the Couch may be upright or vertical, and in any other Poſition. It is alſo uſed for each Lay or Impreſſion of Colour, whether in Oil or Water, wherewith the Canvaſs, Wainſcot, or whatſoever elſe is to be painted, is covered ; alſo, a Lay or Impreſſion on any thing, to make it more firm and conſiſtent, or to ſcreen it from the Weather.



COUCHANT [in *Heraldry*] ſignifies couching or lying along ; but with the Head lifted up, ſpoken of a Beaſt ſo borne in an Eſcutcheon ; and holding up the Head, diſtinguiſhes a Beaſt *couchant* from *dormant.*

COUCHE [in *Heraldry*] denotes any thing lying along, as a *Chevron Couche* ſignifies a *Chevron* lying Side-ways, with the two Ends on one Side of the Shield, which ſhould properly reſt on the Baſe.

COVENANT, is the Conſent of two or more to one Thing, to do or give ſomewhat. Covenant is either in Law or in Fact ; a Covenant in Law, is that which the Law intendeth to be made, tho' in Words it be not expreſſed ; as if the Leſſee do demiſe or grant, *&c.* to the Leſſor for a certain Term, the Law intendeth a Covenant on the Leſſor's Part, that the Leſſee ſhall quietly enjoy his Leaſe for his Term againſt all Incumbrances.

Covenant in Fact, is that which is expreſly agreed between the Parties. There is alſo a Covenant Real, and a Covenant merely Perſonal : A Covenant Real is that whereby a Man tieth himſelf to paſs a Thing Real, as Lands or Tenements, as a Covenant to levy a Fine or Land, *&c.* A Covenant merely Perſonal, on the other Side, is where a Man covenanteth with another by Deed to build him a Houſe, or any other Thing, or to ſerve him, or to infeoff him, *&c.*

COVENANT is alſo the Name of a Writ. See *Convention.*

CO-VERSED *Sine*, is the remaining Part of the Diameter of a Circle, after the Verſed Sine is taken from it.

COVERTURE, [in *Law*] is particularly applied to the Eſtate and Condition of a married Woman, who, by the Laws of our Realm, is *ſub poteſtate viri*, and therefore diſabled to make Bargains with any to the Prejudice of herſelf or her Husband, without his Aſſent and Privity, or at leaſt without his Allowance and Confirmation ; and if the Husband alien the Wife's Lands during the Marriage, ſhe cannot gainſay it during his Life.

COVERT-WAY, [in *Fortification*] is a Space of Ground level with the Field, on the Edge of the Ditch three or four Fathom broad, ranging quite round the Half-Moons and other Works toward the Country : It is otherwiſe called Corridor, and hath a Parapet raiſed on a Level, together with its Banquets and Glacis, which from the Height of the Parapet ought to follow the Parapet of the Place till it is inſenſibly loſt in the Field : It hath alſo a Foot Bank. One of the greateſt Difficulties in a Siege is to make a Lodgment on the Covert-way, becauſe uſually the Beſieged Palliſade it along the Middle, and undermine it on all Sides : This is ſometimes called, and that commonly, the Counterſcarp, becauſe 'tis on the Edge of it.

COVINE, [in *Law*] is a deceitful Aſſent or Agreement between two or more, to the Prejudice of one another.

COVING, [in *Building*] a Term uſed of Houſes that project over the Ground Plot, and the turned Projecture arched with Timber, lathed and plaiſtered.

COUNT, [in *Law*] ſignifies as much as the original Declaration in a Proceſs, though more uſed in real than in perſonal Actions, as Declaration is more applied to perſonal than real.

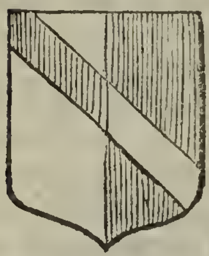
COUNT-WHEEL, is a Wheel in the ſtriking Part of a Clock, moving round once in 12 or 24 Hours: It is by ſome called the *Locking Wheel*, becauſe it hath commonly 11 Notches in it at unequal Diſtances from one another, in order to make the Clock ſtrike 1, 2, 3, 4, *&c.* 'tis driven round by the Pinion of Report.

COUNTER-APPROACHES, [in *Fortification*] are Works made by the Beſieged to hinder the Approach of the Enemy; and when they deſign to attack them in Form.

COUNTER-BATTERY, is one raiſed to play againſt another.

COUNTER-BREAST-WORK, [a Term in *Fortification*] the ſame with *Falſe Bray*.

COUNTER-CHANGED, [is a Term in *Heraldry*] when there is a mutual changing of the Colours of the Field and Charge in an Eſcutcheon, by reaſon of one or more Lines of Partition. Thus in the Coat of the famous *Chaucer*, he beareth *Party per Pale, Argent and Gules, a Bend Counter-changed, i. e.* that Part of the Bend which is in that Side of the Eſcutcheon which is Argent, is Gules, and that Part of it which is in the other Side is Argent.



COUNTER-COMPONED, the Herald's Term for a Bordure, or any Ordinary which hath two Rows only of Checkers of two different Colours; but when it hath three or more, they call it *Checky*.

COUNTER-FORTS, are certain Pillars and Parts of the Walls of a Place, diſtant from 15 to 20 Foot from one another, which are advanced as much as is poſſible in the Ground, and joined to the Height of the Cordon by Vaults to ſupport the Way of the Rounds and Part of the Rampart; as alſo to fortify the Wall, and ſtrengthen the Ground; nevertheleſs they are not at preſent much uſed, except in large Fortifications.

COUNTER-FUGUE, [in *Muſick*] is when the Fugues proceed contrary to one another.

COUNTER-GUARDS, or *Envelopes* [in *Fortification*] are large Heaps of Earth, in Form of a Parapet, raiſed above the Moat, before the Faces and the Point of the Baſtion, to preſerve them; and then they conſiſt of two Faces, making an Angle Saliant, and parallel with the Faces of the Baſtion. If they are deſigned to cover one of the Faces of the Baſtion, they are ſhaped like a Demi-Baſtion, with a Parapet on the Face and Capital, but none on the Flank, which muſt lie open, and be expoſed to the Fire of the Place; but there are few Places now fortified after this manner, by reaſon of the exceſſive Charge it requires.

COUNTERMAND, is, where a Thing formerly executed, is afterwards, by ſome Acts or Ceremony, made void by the Party that had firſt done it.

COUNTER-MARCH [in the Art of War] ſignifies changing the Face or the Wings of a Battalion, and this is done either by Files or by Ranks.

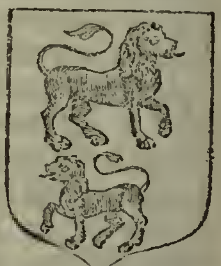
COUNTER-MARCH *by Files*, is when thoſe Men that are in the Front of the Battalion, go into the Rear.

COUNTER-MARCH *by Ranks*, is when the Wings or Flanks of the Battalions change Ground with one another.

COUNTER-MINE [in *Fortification*] is a ſubterraneous Paſſage made by the Beſieged, in ſearch of the Enemy's Mine, to give Air thereto, to take away the Powder, or by any other Means to fruſtrate the Effect of it, tho' it ſhould even happen to be fired by the Aſſailants.

COUNTER-PART, a Term in Muſick, only denoting one Part to be oppoſite to another, as the Baſe is ſaid to be the Counter-part of the Treble.

COUNTER-PASSANT [in *Heraldry*] is ſaid, when there are two Lions, or other Beaſts, in the ſame Eſcutcheon, the one paſſing or walking one way, and the other another, ſo that they look the direct oppoſite ways.



COUNTER-PLEA [in *Common Law*] ſignifies that which the Demandant alledgeth againſt a Tenant in Courteſy or in Dower, who prayeth in Aid of the King; or him who hath the Reverſion for his better Defence.

COUNTER-POINT [in *Muſick*] is a Term whereby is underſtood the old Manner of compoſing Parts, before Notes of different Meaſure were invented; which was to ſet Pricks or Points one againſt another, to denote the ſeveral Concords; the Length or Meaſure of which Points was ſung according to the Quantity of the Words or Syllables whereto they are applied; ſo that, in regard that in compoſing our Deſcant, we ſet Note againſt Note, as the Ancients did Point againſt Point, the Term *Counter-Point* is ſtill retained in theſe Compoſitions.

COUNTER-SALIENT, is when two Beaſts are born in a Coat of Arms in a Poſture of leaping from each other directly the contrary Way.

COUNTERSCARP [in *Fortification*] is that Side of the Ditch which is next the Camp, or properly, the Talus that ſupports the Earth of the Covert-way; altho' by this Term is often underſtood the whole Covert-way, with its Parapet and Glacis; and ſo it is to be underſtood, when 'tis ſaid, *The Enemy lodged themſelves on the Counterſcarp.*

COUNTER *Swallow's Tail*, is an Out-work in *Fortification*, in the Form of a ſingle Tenaile, wider next the Place, *i. e.* at the Gorge, than at the Head, or next the Campaign. The Sides of this *Counter Swallow's-Tail* are not ſo well flank'd from the Place as thoſe of the *true Swallow's Tail*; and therefore 'tis not ſo good.

COUNTER-TENOR, one of the mean or middle Parts of Muſick, ſo called as it were oppoſite to the Tenor.

COUNTER-TRIPPING, when two Stags or other Beaſts are borne in a Coat of Arms tripping, *i. e.* in a walking Poſture, and the Head of one is to the Tail of the other, the Heralds ſay they are *Counter-Tripping*.

COUNTERS, are two Parts of a Ship; the upper Counter is reckoned from the Gallery to the lower Part of the ſtraight Piece of the Stern: The lower Counter is between the Tranſom and lower Part of the Gallery.

COUNTING-HOUSE, in the King's Houſhold. See *Green-Cloath*.

COUNTY-COURT, is a Court held every Month by the Sheriff, or his Deputy the Under-Sheriff.

COUPED, is the Herald's Word for any thing in an Eſcutcheon which is born, cut clear and evenly off, in oppoſition to its being torn off, which they call *Eraſed:* Thus the Arms of *Ulſter*, which all Baronets carry, is a *Dexter Hand*, couped, or cut off at the Wriſt.

COUPLE *Cloſe*, a Term in *Heraldry*, ſignifying the Fourth Part of a Chevron : Theſe are never born but in Pairs, except a Chevron be between them, ſaith *Guillim*, but *Bloom* gives us an Inſtance to the contrary.

COURANT [in *Heraldry*] running as a *Buck Courant*, ſignifies a Buck in a running Poſture, as in the Figure annexed ; and the like of any other Animal.

COURSE [in *Navigation*] is that Point of the Compaſs, or Coaſt of the Horizon, on which the Ship is to be ſteered from Place to Place ; or rather the Angle between the Rumb-Line and the Meridian.

COURSES [in a *Ship*] are her Main-ſail and Fore-ſail ; when ſhe ſails under them only without lacing on any Bonnets, they ſay then ſhe goes under a Pair of Courſes.

COURSE [in *Architecture*] a continued Range of Stones, level, or of the ſame Height, throughout the whole Length of the Building, without being interrupted by any Aperture.

COURSE *of Plinths* [in *Architecture*] is the Continuity of a Plinth of Stone, or Plaiſter in the Face of a Building ; to mark the Separation of the Stones.

COURT, is a Word that has divers Significations ; but, in *Law*, 'tis the Place where Juſtice is judicially adminiſtred, of which you find Thirty-two ſeveral ſorts in *Crompton's* Book of *Juriſdictions*, well deſcribed, and of them, moſt are *Courts of Record* ; ſome be not, and therefore are accounted *Baſe Courts*, in Compariſon of the reſt. Beſides theſe, there are alſo *Courts-Chriſtian*, which are ſo called, becauſe they handle Matters, eſpecially appertaining to Chriſtianity ; and ſuch as, without good Knowledge in Divinity, cannot be well judged of ; and therefore the Judges are Divines, as, Archbiſhops, Biſhops, Archdeacons, and the like.

COURT-BARON, is a Court that every Lord of a Manor hath within his own Precincts : And this Court is two-fold ; as if a Man having a Manor in Town, do grant the Inheritance of the Copyholders thereunto belonging to another ; this Grantee may keep a Court for the Cuſtomary Tenants, and accept Surrenders to the Uſe of others, and make both Admittances and Grants. The other Court is of Free-holders, which is properly called *The Court Baron*, wherein the Suiters, that is, the Free-holders be Judges ; whereas of the other, the Lord, or his Steward, is Judge.

COURT *of Chivalry*, or the *Marſhal's Court* ; the Judges are, the Lord High Conſtable and the Earl Marſhal of *England*. This Court is the Fountain of Martial Law, and the Earl Marſhal is not only one of the Judges, but is alſo to ſee Execution done.

COURT-*Chriſtian*, or *Eccleſiaſtical*, is ſo call'd in oppoſition to the Civil Court, or Lay Court, or *Curia Domini Regis* : Theſe Courts of Chriſtianity were not only held by the Biſhops in Synods, and the Arch-Deacons and Chancellors in Conſiſtories : But they where alſo the Rural Chapters were the Rural Dean, or Dean of Chriſtianity preſided, and the Clergy were Aſſeſſors and Aſſiſtants. Dr. *Kennet's Gloſſary*.

COURT *of Delegates*. See *Delegates*.

COURT *of Peculiars*, is a Spiritual Court held in ſuch Pariſhes as are exempt from the Juriſdiction of the Biſhops, and are peculiarly belonging to the Archbiſhop of *Canterbury*.

COURT *of Requeſts*, is a Court of Equity, of the ſame Nature with the *Chancery*, but inferior to it, being principally inſtituted for the Help of ſuch Petitioners, as in conſcionable Caſes, deal by Supplication to his Majeſty. This Court had aſſumed ſo great Power to itſelf, that it grew burthenſome and grievous, and therefore it was taken away with ſome others, by a Statute made 16 and 17 *Car.* I. *Cap.* 10.

COURTINE, or *Courtain*. See *Curtain*.

COURTESY, or Curteſy of *England*, ſignifies, with us, a certain Tenure, whereby a Man marrying an Inheritrix, that is, a Woman ſeized of Lands of Fee-ſimple, or Fee-tail General ; or ſeized, as Heir of the Tail Special, and getteth a Child by her, that cometh alive into the World, tho' both it and his Wife die forthwith ; yet, if ſhe were in Poſſeſſion, he ſhall keep the Land during his Life, and is called, *Tenant* per legem *Angliæ*, or, *Tenant by the Courteſy* of *England* ; becauſe this Privilege is not allowed in any other Country, except *Scotland*, where 'tis called, *Curialitas Scotiæ*.

COUSSINET [in *Architecture*] a Cuſhion, the Stone that crowns a Piedroit or Peer, or that lies immediately over the Capital of the Impoſt, and under the Sweep. It is alſo uſed for an Ornament in the *Ionick* Capital, between the *Abacus* and *Echinus*.

COUSSU, COUSU [in *Heraldry*] is the ſame as *Rempli*, and ſignifies a Piece of another Colour or Metal, placed on the Ordinary as it were ſewed on ; this is generally Colour upon Colour, or Metal upon Metal, contrary to the General Rule of Heraldry ; and therefore this Word is uſed, according to the Signification of the *French* Word, to diſtinguiſh that the Piece is not properly upon the Field, but in the Nature of a Thing ſewed on. *F.*

COUTEULAUGH, he that willingly receiveth and cheriſheth, or hideth an Out-Law.

COUVERT [in *Heraldry*] ſignifies ſomething like a Piece of Hanging, or a Pavilion falling over the Top of a Chief, or other Ordinary, ſo as not to hide, but only be a Covering to it.

COWARD. When a Lion is born in any Eſcutcheon, with his Tail doubled, or turned in between his Legs, they call it *a Lion Coward*.

COXÆ *Muſculi* [*Anatomy*] a Pair of Muſcles ariſing, fleſhy, from the *Os Iſchium*, between the *Muſculi Marſupialis* and *Pyriformes*, and deſcending obliquely, do terminate on each Side the *Os Coccygis* and adjoining Part of the *Os Sacrum*, ſerving to draw the *Os Coccygis* upwards and inwards.

COXENDIX, the ſame with *Coxa*, and the *Os Iſchium* is the Third and Inferior of the *Oſſa Innominata*, having a large Cavity, called *Acetabulum Coxendicis*, which receives the Head of the Thigh-Bone ; the Circumference of this Cavity is tipt with a Cartilage, called its *Supercilium*. Where it joins the *Os Pubis*, it hath a large Hole called the *Foramen Iſchium*, and *Pubis*, about whoſe Circumference, the Muſcles called *Obturator Externus* and *Internus* do ariſe. At its lower End, it hath a large

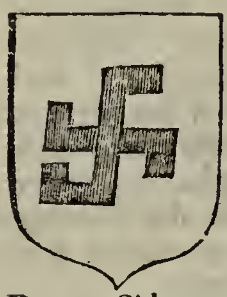
Protuberance on which we ſit, and from whence the Benders of the Legs ariſe ; and a little above this, behind, it hath a ſmall acute Proceſs, between which and the former Protuberance, lies the *Sinus* of the *Iſchium*, thro' which the Tendon of the *Obturator Internus* paſſes. *L.*

CRABB, an Engine of Wood with three Claws, placed on the Ground like a Capſtern, which is uſed to launch Ships, or to heave them into the Dock.

CRADLE, ſo the Ship-Wrights call a Frame of Timber raiſed along the Out-ſide of a Ship, by the Bildge, ſerving the more ſecurely and commodiouſly to help to launch a Ship. This is much uſed in *Italy*, *Spain*, and *Turkey* ; where, for Safety's ſake, they alſo trim a great Ship in the Cradle.

CRAFT, is a Sea Wod ſignifying all manner of Lines, Nets, Hooks, *&c.* which ſerve for Fiſhing ; and becauſe thoſe that uſe the Fiſhing-Trade, uſe ſmall Veſſels, ſuch as Ketches, Hoys, and Smacks, *&c.* they call all ſuch little Veſſels *Small Craft.*

CRAMA, CROMA, CHRAMA, is a Mixture of any thing, whether Medicines or Elements. *Blanchard.*



CRAMPONNE [in *Heraldry*] as a *Croſs Cramponne*, ſo called, has a Cramp at each End, or a Square Piece coming from it ; that from the Arm in Chief towards the ſiniſter Angle, that from the Arm on that Side downwards, that from the Arm in Baſe towards the Dexter Side, and that from the Dexter Arm upwards, as in the Eſcutcheon.

CRANAGE [in *Law*] is a Liberty to uſe a Crane for the drawing up of Wares from the Veſſels, at any Creek of the Sea, or Wharf, unto the Land, and to make Profit of it : It ſignifies alſo the Money taken and paid for the ſame.

CRANE *Lines* [in a *Ship*] are Lines going from the Upper-End of the Sprit-Sail-Top-Maſt to the Middle of the Fore-ſtays ; they ſerve to keep the Sprit-Sail-Top-Maſt upright and ſteady in its Place, and ſtrengthen it, in order that it may bear its Yard and Sail the better.

CRANE's *Bill*, a ſort of Forceps uſed by Surgeons, ſo named from its Figure.

CRANIUM, is the Compages of the Bones of the Head, to which belong the Bones of the Forehead, of the Sides of the Head, of the hinder Part of the Head, of the Temples, the Bone called *Sphenoides*, and another called the *Os Cribriforme* : It is like a Κράνος, or Helmet, to the Head, which defends it from external Injuries ; its upper Part is double. Some call it *Calva* and *Calvaria*. See *Calva.*

Each Bone in the Cranium is made up of two Tables or Lamina, between which there is a thin and ſpungy Subſtance made up of ſome bony Fibres which come from each Laminæ, called (in *Greek*) *Diploe*, (in *Latin*) *Meditullium*. In it there are a great Number of Veins and Arteries, which bring Blood for the Nouriſhment of the Bones. The Tables are hard and ſolid, becauſe in them the Fibres of the Bones are cloſe to one another. The *Diploe* is ſoft, becauſe the Bony Fibres are at a greater Diſtance one from another, by which Contrivance the Cranium is not only made lighter, but is alſo leſs ſubject to be broken. The external Lamina is ſmooth, and covered with the Pericranium : The internal alſo is ſmooth, but on it there are ſeveral Furrows made by the Pulſe of the Arteries, and the *Dura Mater*, whilſt the Cranium was ſoft and yielding.

The Bones of the Cranium are joined by four Sutures, the *Coronalis*, the *Lambdoidalis*, the *Sagittalis*, and the *Squamoſa*. The three firſt of which are called *Saturæ Veræ*, the laſt *Falſa*. The Bones of the Cranium are Six proper, as the *Os Frontis*, making the Front of the Skull ; the *Os Occipitis*, which makes the Hinder-part ; the *Oſſa Parietalia* and *Temporum*, which conſtitute the Sides ; and two *Common Bones*, as the *Os Sphenoides*, and the *Os Ethmoides* : All which ſee under theſe Words.

CRANK, the Sea Term for a Ship that cannot bear her Sails, or can bear but a ſmall Sail, for fear of overſetting : And they ſay, *She is crank by the Ground*, when ſhe cannot be brought on Ground without Danger of overthrowing her.

CRAPULA, is an Head-ache, proceeding from too much Wine. *L. Blanchard.*

CRASIS [Κρᾶσις, *Gr.*] or *Temperamentum*, is a convenient Mixture of Qualities in an Animal Body. *Blanchard.*

CRASIS [in *Grammar*] is the ſame with *Synæreſis*, and draws two Letters belonging to different Syllables, into one Syllable, as *Vement* for *Vehement.*

CRASSAMENTUM [in *Anatomy*] the Cruor of the Blood, or that Part which forms the *Coagulum*, when it has ſtood to cool or ſeparate.

CRATER, a *Cup*, [in *Aſtronomy*] a Conſtellation of the Southern Hemiſphere.

The Stars in the Conſtellation Crater in *Ptolemy*'s Catalogue 7, in *Tycho*'s 8, in the *Britannick* Catalogue 11.

CRATICULA, is a Chymical Inſtrument, made of ſquare Pieces of Iron as thick as one's Finger, placed ſo near one another in acute Angles, that there's half a Finger's Space betwixt them : It is uſed in making of Fires to keep up the Coals. *Blanchard. L.*

CRASING-*Mill.* See *Craze-Mill.*

CRAYONS, are Pencils of ſeveral Colours made purpoſely to paint withal : They are chiefly uſed in Pourtraits ; and Pictures done after this Way of Painting, are ſaid to be done with *Crayons.*

CRAZE-*Mill*, or *Crazing-Mill*, is a Mill, (in all reſpects like a Griſt Mill to grind Corn) and is ſo called by the Tin Miners, who uſe it to grind their Tin, which is yet too great, after trambling ; and then 'tis trambled only. See *Tin.*

CREAM *of Tartar*, is Tartar boiled in a great deal of Water, ſo that as much of it as can, may be there diſſolved ; then the Diſſolution is paſſed hot through *Hippocrates* his Sleeve, and about half the Liquor being evaporated, the Remainder is ſet in a cool Place, and the Tartar will ſhoot into Cryſtals, and ſome of it be like a Cream on the Top of the Water : This latter is properly the Cream of Tartar, and the former are Cryſtals of Tartar, though both are of the ſame Nature and Uſe.

Sometimes the Ruſt of Iron powdered is boiled in the Water along with the Tartar, and then the Cryſtals are called the *Chalybeate Cryſtals of Tartar.*

CREEPING *Index.* See *Brachiolum.*

CREMASTER, [κρεμαστὴρ, *Gr.*] the Name of a Muſcle, otherwiſe (from its uſe) called *ſuſpenſor Teſticuli* : 'Tis deſigned to keep the Teſtes from hanging down too much, and alſo to raiſe them up in Coitu.

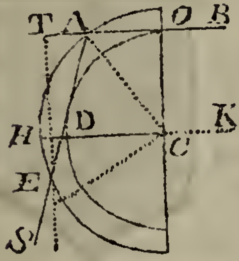
CRENATED *Leaves* [in *Botany*] ſuch Leaves of Plants as are ragged or notched.

CRENELLE, [in *Heraldry*] or imbattelled in *Engliſh*, from the *French* Word *Cren*, ſignifying a Notch or Interval, ſignifies when any honourable Ordinary is drawn like the Battlements on a Wall to defend Men from the Enemy's Shot; that is, the Wall riſing at ſmall Intervals ſo as to cover them, and lower at thoſe Intervals; and the Uſe of it is taken from ſuch Walls, either for having been the firſt at mounting them, or the chiefeſt at defending them, as in the Figure.

CRENGLES, [in a *Ship*] are ſmall Ropes ſpliced into the Bolt-ropes of the Sails of the Main-maſt and Fore-maſt; they are faſtened to the Bowling Bridles, and are alſo to hold by, when a Bonnet is ſhaken off.

CREPITATION, [in *Chymiſtry*] that Noiſe which Salts make over the Fire in Calcination.

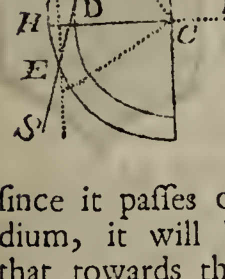
CREPUSCULUM ſignifies Twilight, either Morning or Evening. See *Twilight*. *L.*



Demonſtration.

Suppoſe an Obſerver in O, the ſenſible Horizon A B, and the Sun under the Horizon in H K; and let the Ray S E fall in the Atmoſphere below the Horizon; ſince it paſſes out of a rarer into a thicker Medium, it will be refracted, (ſee *Refraction*) and that towards the Perpendicular, *i. e.* towards the Semi-diameter C E, it will not therefore proceed in T, but touching the Earth in D, will fall upon it, the Eaſtern Part of the ſenſible Horizon; nor can any other Ray beſides A D, of all thoſe reflected from E, arrive at A. But now ſince the Particles of the Atmoſphere reflect the Sun's Rays, (ſee *Reflection*) and ſince the Angle D A C is equal to C A O, the reflected in A will be carried to O, the Place of the Spectator, who will therefore ſee the Particle A ſhining in the ſenſible Horizon, and conſequently the Beginning of the Morning Crepuſculum.

And in the ſame manner might be ſhewn the Refraction and Reflection of the Sun's Rays in the Atmoſphere, in the Evening Crepuſculum.



CRESCENT, the Herald's Term for an Half-Moon, which they draw of this Figure; and though it be ſometimes borne as Coat Armour, yet it is uſually the diſtinguiſhing Mark of the 2d Brother or Family from the firſt.

CREST, [in *Heraldry*] ſignifies that Repreſentation, whatever it be, whether of animal, vegetable, or other artificial Things, which is borne on a Wreath, Chapeau, *&c.* on the Top of the Helmet in any Atchievement: This they call alſo the *Cogniſance*.

CREUX, [in *Sculpture*] a Kind of engraving, *&c.* where the Lines and Figures are cut and form'd within the Face or Plan of the Plate or Matter engraven; and in this it is in Oppoſition to *Relievo*, where the Lines and Figures are emboſſed, and riſe prominent above the Face of the Matter.

CRIBRATION, the Chymiſt's Word for ſifting any Powder, or paſſing it thro' a fine Sieve. *L.*

CIBROSUM *Os.* See *Ethmoides*. *L.*

CRIBRUM *benedictum antiquorum*, the Ancients fancied two Cavities placed long-ways in the Reins; one uppermoſt, wherein the ſerous Blood was poured from the emulgent Arteries; another lowermoſt, which they fancied was diſtinguiſhed with a certain tranſverſe Membrane full of little Holes like a Sieve; whence they called it *Colatorium*, a Strainer; and *Benedictum Cribum*, a bleſſed Sieve, through which they would have the Serum percolated into the Ureters, and the good Blood ſtay behind for the Nouriſhment of the Reins. *Blanchard.* *L.*

CRICOARYTÆNOIDES, [of κρὶκος, a Ring, ἀρύω, to drink, or ἀρυτὴς, a Cup to drink out of, and εἶδος, *Gr.* Form] are Muſcles which proceed from the Cartilage called *Cricoides*, laterally, and are inſerted into the Arytænoides, which, whilſt they draw the Arytænois ſide-ways and outwardly, the Opening or Rimula of the Larynx is dilated. *Blanchard.*

CRICOIDES, [of κρικος and εἶδος, *Gr.* Form] is the Cartilage of the Larynx or Windpipe, in Faſhion of a Ring.

CRICOTHYROIDES, [of κρὶκος θυρεὸς, an Helmet, and εἶδος, *Gr.* Form] a Pair of Muſcles which proceed from the Cartilage of the Larynx like a Ring from the Fore-part of the Cricoides, and are terminated in that which is called the *Scutiformis*; they dilate the Opening of the Larynx by moving a little obliquely: Its uſe is to pull up the Annularis.

CRIMEN *Ambitus*, is getting into publick Offices by bribing with Money or other Gifts; or by canvaſing with Intreaties; as the Civilians define it. *L.*

CRIMEN *Falſi*, [in the *Civil Law*] is a fraudulent Suppreſſion or Imitation of Truth to the Prejudice of another; ſo that the Commiſſion of this Crime conſiſts in three Points, Corruption of Truth, Deceit, and Damage to another. *L.*

CRIMEN *fraudatæ annonæ*, is the abuſing Markets, by raiſing the Price of Victuals unreaſonably, by foreſtalling, monopolizing, *&c.* *L.*

CRIMEN *Peculatus*, (*a Pecore, Cattle*, in which Riches conſiſted before the Uſe of Money) [in the *Civil Law*] is the Crime of ſtealing the pub- Treaſure, or cheating in the publick Accounts. *L.* And much of the ſame Nature is what they call,

CRIMEN *Reſidui*, which is applying the publick Money to other Uſes and Purpoſes than thoſe the Government orders and appoints, or elſe not applying it to any Uſe at all.

CRIMNODES, [κριμνώδης, *Gr.*] or *Crimoides*, is Urine with thick Sediments at the Bottom like Bran. *Blanchard.*

CRISIS, [κρίσις, *Gr.*] is a ſudden Change in a Diſeaſe, either towards a Recovery or Death: It ſometimes ſignifies a Secretion of Humours, but is more frequently taken for a Judgment paſſed upon a Diſeaſe; one Criſis is called perfect, another imperfect; the perfect is that which frees the Patient perfectly from the Diſtemper, and it is either ſalutary or deadly; an imperfect Criſis is that which does not clearly determine the Tendency of the Diſeaſe, but leaves Room for another Criſis; and this is two-fold, either for the better, or for the worſe; the former is that which does not quite take away the Diſeaſe, but enables the Patient to bear it better; the latter is when the Diſeaſe becomes more violent and dangerous. *Blanchard.*

CRISTA *Galli*, is the third Part of the Bone Ethmoides, or the inner Proceſs, not much unlike the Comb of a Cock; it ariſes betwixt the Olfactory

Nerves, and has the Extremity of the third Cavity of the hard Skin of the Brain, called *Dura Mennix*, implanted in it. *L.*

CRISTÆ, are Excreſcencies of Fleſh growing about the Fundament, the Roots whereof are often chapt and cleft. *Blanchard. L.*

CRITERIUM, or *Criterion*, [*κριτήριον, Gr.*] is a Judgment made of the Truth or Falſhood of a Propoſition, the Nature or Qualities of any Effect, *&c.*

CRITHE, or *Hordeolum*, is a little oblong Puſh or Swelling which grows to the Eye-brows where the Hairs are; ſo call'd from its Reſemblance to a Barly Corn. *Blanchard.*

CROCI, is a Word the Botaniſts uſe ſometimes for the Apices of Plants; which ſee. *L.*

CROCODILITES, [in *Rhetorick*] a captious and ſophiſtical Way of Argumentation, diſpoſed to ſeduce the Unwary, and draw them into a Snare.

CROCUS [with *Chymiſts*] a Name given to ſeveral Preparations on Account of their Saffron Colour.

CROCUS *Martis*, or Saffron of Steel, ſo called from its reddiſh Colour: Of this there are ſeveral Kinds, and divers Ways prepared. *L.*

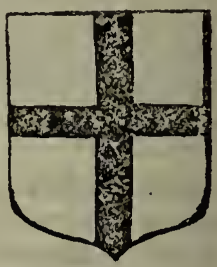
CROCUS *Martis Aperiens*, opening Saffron of *Mars*: Mr. *Lemery*, with great Probability, aſſerts the beſt Way of preparing this, is only to waſh Iron Plates, and then expoſe them to the Dew till they have contracted a Ruſt, which Ruſt is the Crocus, and may be ſcraped off, and the Plates waſhed and expoſed for more. He gives another good Way, which is, to expoſe Filings of Iron (for Steel is not ſo fit for medicinal Uſes) in an Earthen Pan to the Rain, till they become a Kind of Paſte, which is dried and powdered, and expoſed again to the Rain, and this for twelve Times. Others calcine Filings of Iron, or Steel, with an equal Weight of common Sulphur; and ſome heat a Bar of Iron Red, or rather White-hot, and then clap it between two Rolls of Brimſtone, and the Iron will melt, and run down into a Veſſel of Water below: Steel ſo prepared, or by the former way, is called *Mars cum Sulphure præparatus.* Dr. *Willis*'s Way was, to mix Tartar with Steel-Filings, and, no doubt, many other Proceſſes of this kind there are, all of which may be good Aperitives, tho' many aſſert the giving Filings in Subſtance, is as good a Way as any.

CROCUS *Martis Aſtringens* (*Binding Saffron of Steel*) is the Filings of Iron deprived of their more ſaline Parts, which is done by waſhing them five or ſix times in ſtrong Vinegar, and then calcining them five or ſix Hours in a ſtrong Fire in a Pot, or upon a Tile. There are many other ways of preparing this *Aſtringent Crocus*; but this is a very good one. *L.*

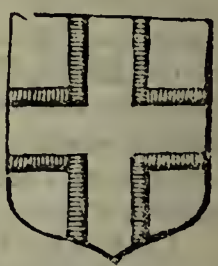
CROCUS *Metallorum*, is a kind of impure and opake Glaſs of Antimony, of a Liver Colour, whence often called *Hepar*, or Liver of Antimony, made by firing equal Parts of Powder of Antimony, and Salt-petre, well mix'd in an Iron Mortar covered with a Tile. 'Tis kindled by dropping in a Coal of Fire: A great Detonation enſues, which when over, ſtrike the Mortar to make the Matter fall to the Bottom: The ſhining Part is the Crocus or Liver, which muſt be ſeparated from the Droſs, waſhed, and kept for Uſe. Of this uſually is made the Emetick Wine, or *Vinum Benedictum*, by infuſing an Ounce of the Crocus powdered, in a Quart of Wine, for 24 Hours. *L.*

CRONICAL. See *Acronical.*

CROOTES, is a Subſtance found about the Oar in the Lead-Mines in *Mendip*, being a mealy, white, ſoft Stone, matted with Oar.



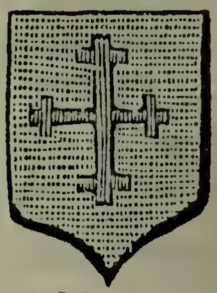
CROSS, one of the Honourable Ordinaries in Heraldry, containing One Fifth of the Field. There is great Variety in its Form, according to the Lines that compoſe it; but a plain Croſs is figured thus, by the Name of *Rainsford.* He beareth Argent, a Croſs-Sable.



Sometimes there is a Line drawn parallel to the Out-line of the Croſs, and then the Field is ſuppoſed to appear through; this is called a Croſs voided, and born thus.

He that beareth Argent, a plain Croſs voided Azure; and ſometimes the Croſs is couped, as well as voided.

CROSS-BAR-SHOT, is a round Shot, or great Bullet, with a Bar of Iron put thro' it.



CROSS-LETS, are little plain Croſſes, whoſe Ends alſo bear the Form of a plain Croſs. They are thus figured, and are frequently born *Fitchee*, that is, pointed at Bottom. See *Fitchee.*

CROSS *Multiplication*, is a kind of Multiplication much uſed by Workmen in meaſuring their Work; and 'tis ſo called, becauſe they multiply acroſs, Feet by Inches, *&c.*

As ſuppoſe it were required to multiply 5 Foot, 3 Inches, and 6 Parts, or $\frac{6}{12}$ of an Inch, by 2 Foot, 4 Inches, and 6 Parts. They ſet the Number down thus:

Then ſay,

	F.	*I.*	*P.*	
	5	3	6	
	2	4	6	
Twice 5 Feet is 10 Feet, which they write down, firſt of all, as you ſee under Feet	10	0	0	
Twice 3 Inches is 6 Inches	0	6	0	
Twice 6 Parts is 1 whole Inch	0	1	0	
Then working with 4, 4 Times 5 Feet is 20 Inches	1	8	0	
Four times 3 Inches gives 12 Primes, or one Inch	0	1	0	
Four times 6 Parts or Primes give 24 Seconds, or 12th of the 12th of an Inch, which makes two Twelfths	0	2	0	
Six times 5 Feet gives 30 Inches	0	2	6	
Six times 3 Inches is 18 Parts	0	0	1	6 *S.*
Six times 6 Parts produce 36 Thirds or Twelfths of a Second, which makes	0	0	0	3 *S.*
	12	6	9	9

And this Method they are very fond of (tho' it be very abſurd in Reality; for to multiply Inches by Feet, *&c.* i. e. a Thing of one Name or Denomination by another, is Nonſenſe); and I believe they generally uſe it becauſe of its Diſpatch.

CROSS-*Staff*, is an Inſtrument made of Box or Pear-Tree, commonly called the *Fore-ſtaff*, becauſe of taking forward Obſervations; and may be made alſo a *Back-ſtaff*, by adding a fourth Vane and Sight. 'Tis uſed by Seamen to take the Meridian Altitude of the Sun or Stars, in order to find the Latitude: 'Tis alſo by ſome uſed in Surveying, to take Angles.

The Deſcription and Uſe of this Inſtrument is as follows:

The Staff is uſually made three Foot long, having 4 Sides ſquare to one another, about Half an Inch over; and each is graduated like a Line of Tangents, and to every Side belongs a peculiar Croſs-Piece. The Staff may be divided either by a Table of Natural Tangents, or Geometrically, by the Diviſions in the Quadrant of a Circle. Then the Half of the Croſs-Piece being ſuppoſed Radius, the Graduation on the Staff will be the natural Co-Tangents of the Half Arches.

The Uſes of this Inſtrument are, to take the Altitude of the Sun, or of a Star; to take the Diſtance between two Stars, or of any Star from the Moon, &c. and it is uſed, by ſome, to take Diſtances by Land.

To obſerve the Altitude of the Sun or Stars.

There are four Croſſes belonging to the Staff, one called the *Ten-croſs*, which belongs to that Side where the Graduation begins with 3 Deg. and ends with 10 Deg. another called the *Thirty-croſs*, belonging to that Side of the Staff where the Diviſions begin with 10, and end with 30 Deg. The Third is, the *Sixty-croſs*, which belongs to that Side where the Degrees begin at 20, and end at 60. And the laſt is called the *Ninety-croſs*, belonging to that Side where the Graduations begin at 30, and end at 90 Deg.

Now, according as you can gueſs the Sun's Altitude to be, you muſt uſe the proper Croſs: If the Altitude be under 10 Deg. uſe the Ten-croſs; if under 30, uſe the Thirty-croſs; if under 60, the Sixty-croſs; but if above that, uſe the Ninety-croſs.

And the way of obſerving is thus: Having fitted on your proper Croſs, place the flat End of the Staff to the Outſide of your Eye, and as near to your Eye as you can; then look at the Sun, or Star, with the Upper-End of the Croſs, and at the Horizon with the lower End, moving or ſliding the Croſs to and fro, till you can do this exactly; for then the Degrees and Minutes cut by the inner Edge of the Croſs, on the proper Side of the Staff for that Croſs, will give you the preſent Altitude of the Sun or Star.

Unleſs it be hazy and thick Weather, the Obſervation can hardly be made without Prejudice to the Eye: To prevent which, ſome put a coloured Glaſs on the Top of the Croſs, and then they obſerve the Upper-Limb of the Sun, and ſubtract his Semidiameter from the Altitude.

There is a Way alſo of making a backward Obſervation of the Sun's Altitude with the Croſs-Staff, as thus: Fix a Horizontal Vane on the Eye-End of the Staff, and a Shoe of Braſs to the End of any of the four Croſſes, which will ſerve inſtead of a Sight-Vane. Having done this, and fitted the Croſs on upon the Staff, turn your Back to the Sun, and looking thro' the Slit in the Braſs Shoe, lift up or down the End of the Staff, till the Shadow made by the Upper-End of the Croſs fall on the Slit in the Horizon Vane, and that likewiſe, at the ſame time, you can ſee the Horizon thro' the Horizontal Vane at the End of the Braſs, then will the Degrees cut on the proper Side of the Staff, be the Sun's Altitude required.

To obſerve the Diſtance between two Stars, or the Moon's Diſtance from a Star.

Place the flat End of the Staff to the Edge, as in the firſt Obſervation, and looking to both Ends of the Croſs, draw it to and fro, till the Ends will cut the two Stars, or, one the Moon, and the other the Star; then will the Croſs cut the Diſtance between thoſe Objects, on the proper Side of the Staff.

Becauſe there may be a Miſtake in placing the Staff to the Eye, take this Rule to know when it is right: Put the Sixty-croſs on 30 Degrees, on its proper Side of the Staff, and likewiſe the Ninety-croſs on 30 Degrees on its Out-ſide; and then, when by moving the Staff higher and lower, you have placed it ſo, that you can ſee the Upper-End of the two Croſſes in one and the ſame Right-line, and the two lower Ends in another, the Staff is placed right.

CROSS-JACK [in a *Ship*] is a ſmall Yard ſlung at the Upper-End of the Mizen-Maſt, under the Top; it hath no Halliards nor Tyes belonging to it. Its Uſe is, to ſpread and hale out the Mixen-Top-Sail Sheets. This is alſo called the *Croſs-Tree-Yard.*

CROSS-PIECE, is a great Piece of Timber going acroſs the Bitts of a Ship, and unto it is the Cable belayed, when ſhe rides at Anchor.

CROSS-TREES [in a *Ship*] are four Pieces of Timber bolted and let into one another, acroſs, at the Head of the Maſt: Their Uſe is, to keep and bear the Top-Maſts up; for the Foot of the Top-Maſt is always faſtened into them. Thoſe who are more nice, call only thoſe Two of theſe Timbers which go athwart Ships, the *Croſs-Trees*; and then the others they call the *Treſſel-Trees.*

CROSS-TREE-YARD, is a Yard ſtanding ſquare, juſt under the Mizen-Top, and to it the Mizen-Top-Sail is faſtened below.

CROSSIERS, are four Stars in form of a Croſs, which ſerve to ſhew thoſe that ſail in the Southern Hemiſphere, the *Antartick Pole.*

CROTAPHICK *Artery*, ſo ſome erroneouſly call the Tendon of the Muſcle called *Crotaphites*, or *Temporalis.*

CROTAPHITES. See *Temporalis.*

CROTAPHIUM [of Κρόταφος, *Gr.*] a Pain in the Head.

CROTCHET, a Term in *Muſick.* See *Notes*, and *Time.*

CROTCHET [in *Printing*] theſe Marks, for incloſing a Word, Sentence, &c. [ ]

CROWN [in *Geometry*] ſignifies a plain Ring, included between two concentrick Perimeters, and is generated by the Motion of ſome Part of a Right-line round a Centre, the ſaid moving Part not being contiguous to the Centre.

The Area of which will be had, if you multiply its Breadth by the middle Perimeter; for a Series of Terms in Arithmetick Progreſſion, being $n \times \frac{\alpha + \omega}{2}$, *i. e.* the Sum of the firſt and laſt multiplied by Half the Number of Terms, the middle Element muſt be $\frac{\alpha + \omega}{2}$; wherefore that multiplied by the Breadth or Sum of all the two Terms, will give the Crown.

CROWN-WHEEL *of a Watch*, is the Upper-Wheel next the Ballance, which, by its Motion, drives it; and this, in *Royal Pendulum*, is called the *Swing-Wheel.*

CROWNS *of Colours*, are certain coloured Rings, which, like Halo's, appear, but of the Colours of the Rainbow, and at a leſs Diſtance than the common Halo's about the Body of the Sun or Moon. Theſe Sir *Iſaac Newton*, in his *Opt.* Book 2. *p.* 4. ſhews to be made by the Sun's ſhining in a fair Day, or the Moon in a clear Night, thro' a thin Cloud of Globules of Water or Hail, all of the ſame Bigneſs: And according as the Globules are bigger or leſſer, the Diameters of theſe Crowns, or Rings, will be larger or ſmaller; and the more equal theſe Globules are to one another, the more Crowns of Colours will appear, and the Colours will be the more lively.

CROWN-POST, is a Poſt which, in ſome Buildings, ſtands upright in the Middle, between two principal Rafters; and from it there go Struts, or Braces, to the Middle of each Rafter. This is alſo, by ſome, called the *King-piece*, and the *Joggle-piece.*

CROWN-WORKS [in *Fortifications*] are certain Bulwarks advanced towards the Field to gain ſome Hill or Riſing-Ground, being compoſed of a ſpacious Gorge, and two Wings that fall on the Counterſcarp near the Faces of the Baſtion, ſo that they are defended by them, and preſent on the Side of the Field, an entire Baſtion between two Demi-Baſtons, whoſe Faces look towards one another. Thoſe Works have alſo their Half-Moons, and are raiſed only to take up and ſecure ſome large Space of Ground, or to defend the Head of a Camp when it is intrenched.

CROWNED *Horn-work*, is a Horn-work with a Crown-work before it.

CROWS *Bill* [in *Surgery*] an Inſtrument for drawing Bullets, *&c.* out of Wounds.

CROW-FEET [in a *Ship*] are ſmall Lines or Ropes put thro' the Holes of the Dean Mens Eyes, and divided by that Means into ſix or ten, or ſometimes more Parts: They are of no Uſe at all, but are there left hanging by the Boat-ſwain, to make a Shew of ſmall Rigging. They are placed at the Bottom of the Back-Stays of the Fore-Top-Maſt, Mizen-Top-Maſt, and Gallant-Top-Maſt.

There goes alſo a Rope divided into two or four Portions, from the upper End of the Sprit-Sail-Top-Maſt to the Fore-Top-Maſt Stay, which they call the *Sprit-Sail-Top-Sail Crow-Foot.*

CROWS-FEET [called alſo *Caltrops* and *Chauſſe Trapes*] are Irons ſo made, with four Points, of two, three, or four Inches long, that, which Way ſoever they fall, one Point may be uppermoſt; the ſhorter are to ſtrew on Bridges, the longer on the Ground, to gall the Feet of a Body of Horſe.

CRUCIBLE, is a Chymical Veſſel made of Earth, and ſo tempered and baked, as to endure the greateſt Fire. They are uſed to melt Metals, to flux Minerals, Oars, *&c.* and are of this Figure.

A French *Crucible.*

A German *Crucible.*

CRUDITY, in Diſeaſes, is when the Blood (as in continued Fevers) is not yet duly fermented and brought to a right Conſiſtence. Crudity of the Stomach, is when Meat, out of a Defect of Nouriſhment, or ſome other Cauſe, is not rightly fermented and turned into Chyle; and it is threefold, *Apepſia*, *Bradypepſia*, and *Dyſpepſia*, of which in their proper Places. *Blanchard.*

CRUOR, Blood. See *Sanguis. Helmont* makes a Diſtinction betwixt Sanguis and Cruor; the former whereof, he ſays, is the Blood in the Arteries, the latter, that in the Veins.

CRURA, are the two Heads or Beginnings of the marrowy Subſtance of the Brain, called *Medulla Oblongata.*

CRURA *Medulla Oblongata*, the internal Subſtance of the two Sides of the Cerebrum, gathered together as it were into two Bundles.

CRURAL *Artery*, by ſome ſaid to be the Artery of the Thigh, among whoſe Muſcles it divideth itſelf: It is a Continuation of the Iliack Artery, which paſſing out of the Abdomen, and entering into the Thighs, it loſes its former Name, and is called Cruralis. Beſides ſome leſs remarkable Branches, before it come to the Ham, it ſends forth the external and internal Muſcle; under the Ham it produces the two Poplitæa's, and ſomewhat lower the Surales. Afterwards the Trunk itſelf is divided into the Branches called *Anterior* and *Poſterior*; and the laſt of theſe is alſo ſubdivided into two ſmaller Branches which deſcend to the Foot.

CRURAL *Vein*; the Blood is conveyed from the lower Extremity of the Body by ſix Veins, called *The greater and ſmaller Iſchia*, *Muſcula*, *Poplitæa*, and *Saphœna*; which, joined together, compoſe the Trunk of the Crural Vein, which aſcends to the Groin, and ends in the Iliaca.

CRUREUS, or *Femoreus*, is a Muſcle of the Leg, ſo called from its Situation on the Bone of the Thigh, like the Muſculus Branchiæus, on that of the Arm; its Origination is large and fleſhy, being continued from between the greater and leſſer Trochanter of the Thigh Bone forwards to its lower Part; that is, immediately above its inferior Appendix. Its fleſhy Fibres deſcend directly, and become perfectly tendinous a little below the upper Part of the Tendon of the *Rectus*, where it joins with it, and the Tendons of the *Vaſtus Externus* and *Internus*, which paſſes over the external Part of the *Patella* (or on each Side of it) and is inſerted to a Prominence, at the Superior and Fore-Part of the *Tibia*; it helps to extend the *Tibia.*

CRUS, or *Magnus Pes*, is all that Part of the Body which reaches from the Buttocks down to the End of the Toes; and it is divided into the Thigh, Leg, and Foot. *Blanchard. L.*

CRUSTA *Lactea*, is the Species of *Achor*, Scurf, or cruſty Scab, only with this Difference, that an *Achor* infects only the Head; but this not only the Face, but almoſt the whole Body of an Infant, at the Time of its firſt Sucking. *Blanchard.*

Cruſta Lactea turns white, but *Acdors* have only one Colour. *L.*

CRUSTA *Villoſa* [in *Anatomy*] the fourth Tunick or Coat of the Stomach : Innumerable Villi or Fibrillæ are ſeen on the inner Surface of this Coat, riſing every where perpendicularly from it; which ſome ſuppoſe to ſerve for nothing but a Defenſative to preſerve the Stomach from acrimonious Humours : But Dr. *Drake* ſuppoſes them to be rather excretory Ducts to the ſubjacent Glands ; what ſome Authors take to be the Parenchyma, (now exploded) but which are indeed the Organs by which moſt of that Humour, which is diſcharged upon the Stomach, is ſeparated, and theſe Villi the immediate Channels thro' which it is conveyed. *L.*

CRUSTACEOUS [*Cruſtaceous*, *L.*] Shell-Fiſhes, are ſuch as Lobſters, Crabs, Craw-Fiſhes, *&c.* which are covered with Shells conſiſting of ſeveral Pieces, and which uſually are ſofter too than thoſe of the Teſtaceous Shell-Fiſhes, which are all entirely of one Piece, and uſually much harder, thicker, and ſtronger than the former, as the Oyſter, Scollop, Cockle, *&c.*

CRUSTULA, is the ſame as *Ecchymoma* in the Eye, being a Deſcent of Blood from the Arteries into the *Tunica Conjunctiva*, occaſioned by a Wound, Stroke, *&c.* *L.*

CRYMODES, [κρυμώδης, *Gr.*] is a cold ſhivering Fever, but many times accompanied with an Inflammation of the inner Parts. *Blanchard.*

CRYPTOGRAPHY, called alſo *Steganography*, is the Art of ſecret Writing : On which Subject many Books have been publiſh'd ; as, by the Abbot *Trithemius*, in his *Steganographia*, *Francf.* 1608, *4to* by *Guſtavus Selenus*, in 9 Books in *Fol.* printed at *Lunenburgh* 1624, *cum Fig.* by *Schottus*, in his *Schola Steganographica.* Biſhop *Wilkin*'s *Secret and Swift Meſſenger.*

CRYPTORCHIS, [of κρύπτω, to hide, and ὄρχις, *Gr.* a Teſticle] is an abſconding of the Teſticles in the Belly. *Blanchard.*

CRYSTAL, [in *Natural Hiſtory*] a Sort of Mineral, or rather a tranſparent Stone, white like a Diamond, but much inferior to it in Luſtre and Hardneſs.

CRYSTALLINUS *Humor Oculi*, called alſo *Glacialis*, the Cryſtalline Humour of the Eye, lies immediately next to the Aqueous, within the Opening of the Tunica Uvea ; like a Glaſs put over a Hole, it collects and refracts the Rays which ſtrike upon it from all Parts : Its Subſtance is like Glue, or the Gum of a Tree, very pellucid, and of a Conſiſtence like melting Wax, which, though it be preſſed, does not eaſily yield and ſeparate. In Men it is ſhaped like a Lens or Convex Glaſs, which riſes thicker in the Middle than at the Edges : This Humour is the leaſt of all three, but is much more ſolid than any of them, and is cloathed with a ſmall Membrane of its own called *Aranea*, by reaſon of its Thinneſs, like to a Spider's Web.

CRYSTALLOIDES *Tunica*, the ſame with *Aranea Tunica.*

CRYSTALLIZATION, [in *Chymiſtry*] a Kind of Congelation that happens to Salts, both eſſential, fixed, and volatile, when being freed from the greateſt Part of their Humidity, they are left to harden, dry, and ſhoot into Cryſtal.

CUBATURE, [in *Geometry*] is finding exactly the ſolid Content of any propoſed Body ; as the Quadrature of a Surface is finding the Area of that Surface. There is a little Book lately written by one *Fantit* a *Frenchman*, intitled, *De la Cubature de la Sphere*, in which, with great Aſſurance, he pretends to find geometrically the ſolid Content of any Portion of a Sphere ; but how little the Succeſs anſwers the Boldneſs of the Title, I leave the Reader to judge.

CUBBRIDGE-HEADS ; ſo ſometimes are the Bulk-Heads of the Fore-caſtle and the Half-Decks called ; the one the Cubbridge-Head before, the other the Cubbridge Head behind.

CUBE, is a ſolid Body of ſix equal Sides, which are all Squares ; 'tis one of the five regular Bodies, and its Content is found by multiplying any one Side or Face by the Height. See a Table of the different Weight of a Cubick Inch and Foot of ſeveral Bodies under the Word *Weight.*

CUBICAL *Paraboloid.* See *Paraboloid* and *Curves.*

CUBICAL *Artery*, by ſome is ſaid to be a Branch of the Axillary.

CUBICK *Equations*, [in *Algebra*] are ſuch whoſe higheſt Power conſiſts of three Dimenſions, or is a Cubical Quantity ; as $aaa - 3bba = 2ccc$, where the higheſt Power of a, the unknown Quantity, is a Cube.

Our excellent *Harriot* ſhews the Original of all ſuch Kind of Equations, to be either from the continual Multiplication of three lateral or ſimple Equations into one another, after they are firſt reduced to the Form of Binominals ; or elſe by multiplying a lateral Equation into a Quadratick ; by both which Ways the ſame Quantity will be produced, as in this Example.

Let $\left.\begin{array}{l} a+b=o \\ a+b=o \\ a+b=o \end{array}\right\}$ by multiplying of which continually, you will produce the following Quantity, *viz.* $aaa + baa + bca + caa - bda - daa - cda - bcd = o$; which is an origi[illegible] Cubick Equation, as he calls it. And by this [illegible]eans he ſhews, that every Cubick hath, either real or imaginary, three Roots, ſometimes all Affirmative, ſometimes all Negative, or ſome Affirmative and ſome Negative : Of this ſee more in *Harriot* himſelf, or in Dr. *Wallis*'s Algebra, where he gives a large Account of this Method.

As to the Solution of Cubick Equations, though *Harriot*, *Des Cartes*, and others, have given very good Rules, yet no Body hath deduced ſo eaſy, natural, and demonſtrative a Method for it, as the profound Dr. *Wallis* in his Algebra, *Chap.* 46. which he tells us he did in the Year 1647, and is as followeth :

Since *Oughtred* proves, *Ch.* 18. *Art.* 15. of his *Clavis*, that $Zc = Z + 3\text{Æ}Z$, and $Xc = Z - 3\text{Æ}X$, they may be reduced thus, $Zc - 3\text{Æ}Z = Z$, and $Xc + 3\text{Æ}X = {}^{‘}Z$: And then he found that $3AE$ was the triple Rectangle of the two Quantities A and E, whoſe Sum is Z, and ‘Z the abſolute Number was the Sum of their Cubes in the former, but X the Difference of them, and ‘X the Difference of their Cubes in the latter. And he found alſo, that all Cubick Equations might be reduced to one of theſe two Forms; for as for theſe two, $Zc - 3\text{Æ}Z = -Z$, and $Xc + 3\text{Æ}X = -Xc$, where ‘Z and ‘X are negative Quantities, they only differ from the former, in which they are affirmative, in this, that here X and Z will be negative Quantities, whereas there they will be poſitive.

So that all Cubick Equations being reducible to theſe two Forms, the only Difficulty remaining is this, *Having the Rectangle of two Quantities, with the Sum or Difference of their Cubes, to find the*

Quantities themſelves, and conſequently, *their Sum and Difference.*

Which is performed by reſolving a Quadratick Equation of a ſolid Root (or one whoſe Root is a Cube or ſome higher Power).

For $\frac{\text{Æ}}{A}=E$, $\frac{\text{Æ}c}{Ac}=Ec$. $Ac+\frac{\text{Æ}c}{Ac}=Ac+Ec=\text{‘}Z$, and ſo $\frac{\text{Æ}}{E}=A\,\frac{\text{Æ}c}{Ec}=Ac$, and $\frac{\text{Æ}c}{Ec}+Ec=Ac+Ec=\text{‘}Z$; wherefore (multiplying by Ac or Ec, and then tranſpoſing the Terms) $Acc-\text{‘}ZAc=-\text{Æ}c=Ecc-\text{‘}ZEc$, whoſe Roots are $\frac{1}{2}\text{‘}Z\pm\surd:\frac{1}{4}\text{‘}Zq_3-\text{Æ}c=\frac{Ac}{Ec}$.

And by the like Proceſs it will be found, that $Ac-\frac{\text{Æ}c}{Ac}=\text{‘}X=\frac{\text{Æ}c}{Ec}-Ec$; and conſequently, $Acc-\text{‘}XAc=\text{Æ}c=Ecc+\text{‘}XEc$, whoſe Roots are $\surd:\frac{1}{4}\text{‘}Xq3+\text{Æ}c\pm\text{‘}X=\frac{Ac}{Ec}$.

And then will the Sum or Difference of their Cubick Roots be $A+E=Z$, and $A-E=X$; the Roots ſought in thoſe Cubick Equations; that is, $\surd c+\frac{1}{2}\text{‘}Z+\surd:\frac{1}{4}\text{‘}Zq3-\text{Æ}c+\surd:C.+\frac{1}{2}\text{‘}Z-\surd:\frac{1}{4}\text{‘}Zq-\text{Æ}c=A+E=Z$, $\surd:C+\frac{1}{2}\text{‘}X+\surd:\frac{1}{4}\text{‘}Xq3+Ec-\surd C-\frac{1}{2}\text{‘}X+\surd:\frac{1}{4}\text{‘}Xq3+Ec=A-E=X$.

N. B. If, as we ſaid above, the abſolute Quantity be Negative, as $-\text{‘}Z$, or $-\text{‘}X$, the Roots then will be $-A-E=-Z$, and $-A+E=-X$.

How to conſtruct Cubick Equations after Mr. *Baker*'s Way by the Parabola, ſee *Conſtruction of Equations.*

Mr. *Halley*, (now our learned Savilian Profeſſor of Geometry at *Oxon*) in *Philoſ. Tranſact.* N° 190, gives a good Way to extract the Roots of all Cubick Equations by the Help of the Tables of Sines.

CUBICAL *Number*, is that which is produced by the Multiplication of a ſquare Number by its Root: Thus 64 is a Cubick Number, and is made by multiplying 16, the Square of 4 by the Root 4. In Algebra the third Power in a Series of Geometrical Proportionals continued, is called a Cube, as *a* is the Root, *a a* the Square, and *a a a* the Cube: And all Cubick Numbers may be ranged into the Form of Cubes, as 8 or 27, whoſe Sides are 2 and 3, and their Baſes 4 and 9.

Theorem. Every true Cubical Number produced from a Binominal Root, conſiſts of theſe Parts, *viz.* the Cubes of the greater and leſſer Parts of the Root, and of three times the Square of the greater Part multiplied by the leſſer, and of three times the Square of the leſſer multiplied by the greater.

As is plain from bare Algebraical Multiplication in the following Example.

$$\begin{array}{l}
\quad aa+2ab+bb \\
\quad a+b \\
\hline
aaa+2aab+abb \\
\qquad\quad aab+abb+bbb \\
\hline
aaa+3aab+3abb+bbb
\end{array}$$

From whence 'tis very eaſy to underſtand both the Compoſition of any Cubick Number, and alſo the Reaſon of the Method for extracting the Cube Root out of any Number given.

Thus, ſuppoſe 28 were propoſed to be cubed, write it down ſo that there may be Room to write 2 Figures between each Place: as,

$$\begin{array}{ll}
2 \quad 8 & \\
\hline
8\ \ldots & aaa \\
96\ ..= & 3aab \\
384\ . & 3abb \\
512\ \ . & \quad bbb \\
\hline
21952 = & \textit{Cube} \text{ of } a+b \\
\text{———} & \text{or of } 28.
\end{array}$$

I ſay, the Cube of 2 or 8, is 8 or 8000; then 3 times the Square of 2 (which is 12) multiplied by 8, gives 99 = 3 *a a b*, which place orderly under the 8, as you ſee. Next, 3 times the Square of 8 is 192; and that, multiplied by 2, gives 384 = 3 *a b b*; which write alſo orderly, as you ſee. And laſtly, the Cube of 8 is 512, which muſt be written down ſo, that the firſt Figure of it to the Right-hand, may ſtand under 8 in the Root; and then, adding all together, you have 21952, the true Cube of 28.

If the Number to be Cubed *had conſiſted of* 3 *or more Places, as ſuppoſe* 285.

You muſt proceed, as before, to find the Cube of 28, the two firſt Figures towards the Left-hand, which is 21952; then, after that, you are to account that Number as the Cube of *a*, and go on to find the other Members, as follows:

Imagine the next Figure 5, to ſtand 2 Places farther to the Right-hand, and let that be *b*; and 28, or 280, *a*; proceed therefore thus, 3 times the Square of 28 is 2352; which multiplied by 5, makes 11760 = 3 *a a b*; write that down therefore as you ſee: Then ſay, 3 times the Square of 5 is 75; which multiplied by 28, gives 2100 = 3 *b b a*; write that alſo down as you ſee: And laſtly, write the Cube of 5, which is 125 = *b b b*, in its proper Order, as was ſhewed above, and then adding all together, the Sum will be 23149125, the Cube of 285.

$$\begin{array}{r}
2 \quad 8 \qquad 5 \\
\hline
:\ :\ :\ :\ :\ : \\
21952 = aaa \\
11760 = 3aab \\
2100 = 3bba \\
125 = bbb \\
\hline
23149125 \\
\hline
\end{array}$$

And after the ſame manner you muſt proceed on, let the Number to be cubed be never ſo large.

And this Method of the Compoſition of a Cube Number being well underſtood, the Extraction of the Cube-Root will be very eaſy and intelligible by the following Directions.

Suppoſe you were to extract the Cube-Root out of this Number, 23149125.

1. Beginning at the Right-hand, make a Prick, or Point, over the firſt Figure 5, and then over every third Figure afterwards; as many Points as there are, ſo many Figures will you have in your Root.

2. Find

$$\begin{array}{rl}
 & \overset{.}{2}\,3\,1\,\overset{.}{4}\,9\,1\,\overset{.}{2}\,5\ (28 \\
8 & aaa \\
\hline
15249 & \text{Reſolv.} \\
12 = & 3\,aa \\
6 = & 3\,a \\
\hline
126 & \text{Diviſor.} \\
\hline
\hline
126)\ 15149 & (8 \\
\hline
96 = & 3\,aab \\
384 = & 3\,bba \\
512 = & bbb \\
\hline
13952 & \\
\hline
1197125 & \text{Ref.} \\
\hline
(84 = & 3\,a \\
2352 = & 3\,aa \\
\hline
23604 & \text{Div.} \\
\hline
\hline
 & ab \\
23604)\ 1197125 & (285 \\
125 = & bbb \\
2100 = & 3abb \\
11760 = & 3\,aab \\
\hline
1197125 & \\
\hline
0 &
\end{array}$$

2. Find that Cubick Number which is next leſs than 23 (the firſt Part of the given Cube) which is 8, and place its Cube-Root 2, in the Quotient; then write down 8 under, and ſubtract it from 23, and to the Remainder bring down the next Cube 149; ſo will 15149 be the Reſolvend. And thus have you found a the firſt Member of the Root, which is 2, or 200; you muſt next try to find b, (that is) ſuch a Number, as that $3\,aab$, $3\,abb$, and bbb, added all together, ſhall not be greater than 15149, the Reſolvend; for from that Number it muſt be ſubtracted. Since therefore $a = 2$, 3 times $a\,a$ will $=12$; which write down as you ſee: And multiplying a alſo by 3, it produces 6, which ſet down under the former, in the Order as you ſee. Add the two laſt Numbers together, and they make 126, which is to be called a *Diviſor*, and is to divide all the Reſolvend except the laſt Figure on the Right-hand: Enquire therefore how often you can have 126 in 1514; and tho' you can have it 9 times and more, yet 9 times will be too much, as you may ſoon find, if you multiply 9, which is b, according to the Conditions above mentioned: Let therefore the Figure to be placed in the Quotient be $8 = b$, then by 8 multiplying $3\,a\,a$, I find the Product to be 96, which I write down under the Reſolvend, as you ſee: Alſo ſquaring 8, I multiply it by $3\,a$ or 6, and the Product, which is 384, I write down alſo under 96; and then cubing 8, I write 512 under the former Numbers, only one Place more to the Right-hand; and adding all together, they make 13952, which ſubtracted from the Reſolvend 15149, leaves 1197; to which bringing down the laſt Cube 125, you have 1197125 for a new Reſolvend: Then, for a new Diviſor, tripple a, or 28, and it makes $84 = 3\,a$, which place under the Reſolvend one Place backward, to the Left-hand: Tripple alſo the Square of a or 28, and the Product, $2352 = 3\,a\,a$, write under the laſt Number 84, a Place yet more backward to the Left-hand, as you ſee. Add the two laſt Products together for a new Diviſor, and write it on the Left-hand of the laſt Reſolvend; and ſince, on Trial, you will find it may be had 5 times in the Reſolvend, place 5 in the Quotient after 28, then cube 5, and write it under the Reſolvend: Alſo ſquare 5, and multiply that Square by 3 times 28, it makes 2100, which write down under 125, only a Place backward to the Left-hand, as you ſee; then multiply 3 times the Square of 28 by 5, and the Product (which is 11760) ſubſcribe (after the ſame manner) under 2100. Laſtly, add the 3 laſt found Numbers together, and you will find their Sum to be 1197125, which is exactly the Reſolvend, and ſo the Work is over; and 285, the true Cube-Root of the given Number 23149125.

If the Number be not an exact Cube, you muſt add to the laſt Remainder, as many times 3 Cyphers as you deſign Decimal Places in the Root, and ſo proceed as before.

CUBIFORME. See *Cuboides.*

CUBIT, or the *Ulna* [in *Anatomy*] is a long hard Bone, with a Cavity in its Middle, and lies on the Inſide of the Arm, reaching from the Elbow to the Wriſt; but ſome make it to conſiſt of two Bones, the one called the *Ulna*, and the other *Radius.*

CUBITÆUS *Internus & Externus*, are Muſcles of the Wriſt, the one ſerves to bend, the other to extend it. *L.*

CUBITÆUS *Externus*, is one of the Extenders of the Wriſt, ariſing from the external Knob of the *Os humeri*, and is inſerted in the upper and external Part of the *Os metacarpi* of the little Finger. *L.*

CUBITÆUS *Internus*, is one of the Benders of the Wriſt, ſprings from the inner Extuberance of the *Os humeri*, and paſſing along the *Ulna*, ends in the fourth Bone of the *Carpus*, and the *Os metacarpi* of the little Finger.

CUBITAL *Muſcle.* See *Anconæus.*

CUBO *Cube*, the 6th Power of any Number or Quantity.

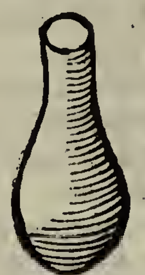
CUBOIDES, is the 7th Bone of the Tarſus of the Foot; it lies in the ſame Rank with the *Oſſa Cuneiformia:* It is called alſo *Grandinoſum* and *Cubiforme;* behind, it is joined to the *Os Calcis;* before, to the two outer Bones of the *Metatarſus*, and on its Inſide it is joined to the *Os Cuneiforme.*

CUCULLARIS and *Trapezius*, is a Muſcle of the *Scapula*, ſo named, becauſe this, with its Fellow, covering the Back, repreſents a Cowl. It ariſes fleſhy from the *Os Occipitis*, tendinous from the *Ligamentum Colli*, and *Apex* of the Spine of the laſt *Vertebra* of the Neck, and eight ſuperior of the *Thorax*; from which broad Origination becoming thick and fleſhy, 'tis ſo inſerted to the *Clavicula*, and tendinous to the *Spina Scapulæ.* Each Muſcle is triangular, and both conjointly compoſe a Lozenge or *Trapezium*, whoſe large Diameter extends from the *Occiput* to the 15th *Vertebræ;* the ſhorter, from near the Extremity of the *Spina Scapulæ* on one Side to that of the other. They contain a triple Series of the Fibres, the Middle paſſing directly tranſverſe from the firſt *Vertebra* of the *Thorax:* Thoſe two deſcend, and thoſe beneath aſcend to their Inſertion, whereby the *Scapula* is variouſly moved, according to their Directions, either obliquely upward, directly back, or obliquely downwards. *L.*

CUCULLATE *Flowers* [in *Botany*] ſuch as reſemble a *Cucullus*, or Monks Hood or Helmet.

CUCUPHA, a Medicine for the Head, made of Odoriferous and Cephalick Spices beat to Powder, and ſtitched between two Pieces of Silk, or elſe ſewed within a Cap, and worn upon the Head, againſt *Catarrhs*, and other Diſeaſes of the Head. *Blanchard.*

CUCURBITE, ſo the *Chymiſts* call a Glaſs, Earthen, or Copper Body of this Shape, becauſe it



ſomething reſembles a Gourd. This Veſſel, with its Head, is moſt commonly uſed in Diſtillations, or Rectifications. They call it uſually a *Body.*

CUCURBITINI *Lumbrici*, are broad Worms that breed in the Inteſtines, like the Seed of a Gourd.

CUCURBITULA, or *Cucurbita*, [a *Cupping-Glaſs*] is a wide hollow Veſſel made of Glaſs or Tin, which it applied to the Body with Scarification, or without it, to divert, to drive the Blood into the other Part, or to drive it out: If it be applied without Scarification, it is called *Cucurbita Cœca* and *Ventoſa.*

Cupping-Glaſſes are applied to the more fleſhy Parts, where the large Veſſels and Nerves cannot be hurt. The Drawing, which is performed by theſe Glaſſes, is done thus: After the Skin is ſcarified, the Air in the *Cupping-Glaſſes* is rarefied and dilated by the Flame of the Tow that is fired within it; which, after it is cooled and condenſed, takes up leſs Room than before; ſo that the external Air preſſing upon the Fleſh without, forces the Blood into the Glaſs. There are two ſorts of *Cupping-Glaſſes*, ſays *Celſus*, one of Braſs, and the other of Horn; the former is open on one Part, and on the other has a little Hole. Burning Tow is thrown into the Brazen one, and ſo its Mouth apply'd and forc'd upon the Body, till it ſticks. That of Horn is applied ſingly by itſelf; and by a violent ſucking at the little Hole, which muſt preſently be ſtopp'd up cloſe with Wax, it ſticks as faſt as the other: But if other things fail, then a little Cup or Goblet, with a ſtreight Mouth, may be very fitly apply'd to the ſame Effect. After it has ſtuck, if the Skin be ſcarified before with a Pen-knife, it draws out the Blood; if it be whole and entire, it draws out the flatulent Matter: Therefore, where the Matter within is hurtful and offenſive, it muſt be apply'd the former Way; where there is an Inflammation, the latter. The *Ægyptians*, at this Day, uſe thoſe of Horn, as appears from *Proſper Alpinus. Blanchard.*

Now, in *England*, we commonly uſe *Cupping-Glaſſes* without Fire, which are evacuated by a ſmall Syringe, which works like an Air-Pump; and for Scarification, they have an Engine that doth it all at once, with great Safety, and very little Pain; and this was the Invention of the ingenious Mr. *Hawksbee* in *Wine-Office Court* in *Fleetſtreet*, who makes the beſt Air-Pumps, and all Pneumatick Engines that ever I ſaw.

CUDDY [in a Firſt-Rate Man of War] is a Place lying between the Quarter-Deck and the Captain-Lieutenant's Cabbin, under the Poop, which is divided into Partitions, for the Maſter and Secretary's Officers.

CUI *ante divortium*, is a Writ that a Woman, divorced from her Husband, hath, to recover Lands or Tenements from him, to whom her Husband did alienate them during the Marriage, becauſe ſhe could not gainſay it. *L.*

CUI *in vita*, is a Writ of Entry that a Widow hath againſt him to whom her Husband aliened her Lands and Tenements in his Life-time; which muſt contain in it, That during his Life-time ſhe could not withſtand it. *L.*

CUL *de Lamp* [in *Architecture*] *i. e.* the Bottom of a Lamp; a Term uſed for ſeveral Decorations both of Maſonry and Joinery, found in Vaults and Ceilings, to finiſh the Bottom-Works, and wreath'd ſomething after the manner of a *Teſtudo*, particularly, a kind of Pendentive in *Gothick* Vaults.

CUL *de Four* [in *Architecture*] a ſort of ſpherical Vault, like an Oven.

CULINARY *Fire* [with *Chymiſts*] a common Fire, ſo called of *Culina*, a Kitchen, in Contradiſtinction to Solar Fire, or that raiſed by the Action of a Burning-Glaſs.

CULMIFEROUS *Plants* [See *Plants*, N. 23.] are, by the *Botaniſts*, accounted ſuch as have a ſmooth-jointed Stalk, and uſually hollow; and at each Joint the Stalk is wrapp'd about with ſingle, narrow, long, ſharp pointed Leaves, and their Seeds are contained in chaffy Husks.

CULMIFEROUS *Plants* are of two kinds; either having, 1. A greater, or 2. A ſmaller Grain or Seed.

CULMIFEROUS *Plants*, with a greater or larger Seed, or Grain, are ſuch as are called *Frumentaceous* and *Cereales*, becauſe their Seeds are uſed for Food; as for Bread, Beer, Broth, *&c.* theſe they call the *Frumenta*, and are

Spicatæ, whoſe Seed is either,

1. Larger and more oblong, and that eaſily ſeparated from its Husk, by pounding, or beating, or threſhing, as Wheat (*Triticum*) and Rye (*Secale*); or not ſo eaſily parting with its Husk, as Spelt (in *Latin*) *Zea*, a ſort of Baſtard-Wheat which grows plentifully in *Italy*, *Germany*, and *France.*

To which they add Barley (*Hordeum*) and Rice (*Oryza*) which are contained in a thicker Husk than Wheat and Rye.

2. Whoſe Seed is cloſe and more round, as *Panick*, which is a Seed much ſown in *Germany*, and eaten by the Inhabitants.

Paniculatæ or *Jubatæ*, whoſe Seed is either

More Oblong, as *Avena Oats*; or
Roundiſh, as *Scordium* and *Milium.*
Paniculatæ and *Spicatæ ſimul*, as the *Indian Maez.*

They reckon alſo ſome *Culmiferous Herbs* which are not eſculent, or uſually eaten by Men; and theſe are either

Spicatæ, as the *Phalaris* (*Canary-Graſs*) and *Lolium*: Or

Paniculatæ, as the *Lacryma Jobi.*

CULMINATE, is a Word uſed by Aſtronomical Writers, to expreſs a Star's, or the Sun's being upon the Meridian, or having the greateſt Altitude that it can have that Day.

The *Culminating* of any Star, or being on the Meridian, may be found by the Globe, thus:

Rectify your Globe and Hour Index, and bring the Star to the Brazen Meridian; then the Index will ſhew the Time of the Star's culminating.

CULMUS [in *Botanicks*] is properly the Stalk of Corn, or of Graſs, but of no other Plant, for that is called *Caulis*.

CUL-PRIT, are Words uſed by the Clerk of the Arraignments, when a Perſon is indicted for a criminal Matter. For after the Indictment is read in Court (which is the Crown's Charge) againſt the Priſoner at the Bar, he is put upon his Plea; or asked, Art thou Guilty, or not Guilty? If he pleads or anſwers, Not Guilty, there is next a Replication from the Crown, by continuing the Charge of Guilt upon him, according to the Tenour of the Indictment; which is expreſſed by pronouncing the Words *Cul-Prit* ; *Cul* being an Abbreviation of the *Latin* Word *Culpabilis*, Guilty ; and *Priſt*, or *Prit*, (now *Pret*) is the old *French* Word for ready. From theſe two Aſſertions therefore of the Clerk of the Arraignment, that the Priſoner is *Culp*, or Guilty of the Crime charged on him, and that the Crown is *Prit* or ready to prove it upon him ; this Word *Cul-Prit* is derived.

And that this is the true Explanation of the Terms *Cul-Prit*, is evident from the Form of the Entry of the Record of the Trial when drawn up at large ; which, as to the Replication pronounced by the Clerk, as aforeſaid, in the Words *Cul* and *Prit*, run thus · *Et Prædictus A.* (the Clerk) *pro Domino Rege dicit, Quod Prædict. B.* (the Priſoner) *eſt Culpabilis*, &c. *Et hoc paratus eſt verificare*, &c.

CULTELLATION [with ſome Authors] the meaſuring of Heights and Diſtances by Piece-meal, by Inſtruments that give ſuch Heights and Diſtances, by Parts, and not all at one Operation.

CULVERING, a ſort of Ordnance, of which there are, the Extraordinary, the Ordinary, and the leaſt ſized *Culvering*.

CULVERING *Extraordinary* has 5½ Inches Bore, 13 Foot long, weighing 4800 ℔ Weight ; its Load above 12 ℔, carries a Shot 5¼ Diameter, weighing 20 ℔ Weight.

CULVERING *Ordinary*, is a Size leſſer.

CULVERING *of the leaſt Size*, is that whoſe Diameter is 5 Inches Bore, 12 Foot long, weighing about 4000 ℔, carries a Shot 3¾ Inches Diameter, weighing 14 ℔ 9 ℥.

CULVERTAIL, the faſtening in of a Ship's Carlings into the Beam, is ſo called.

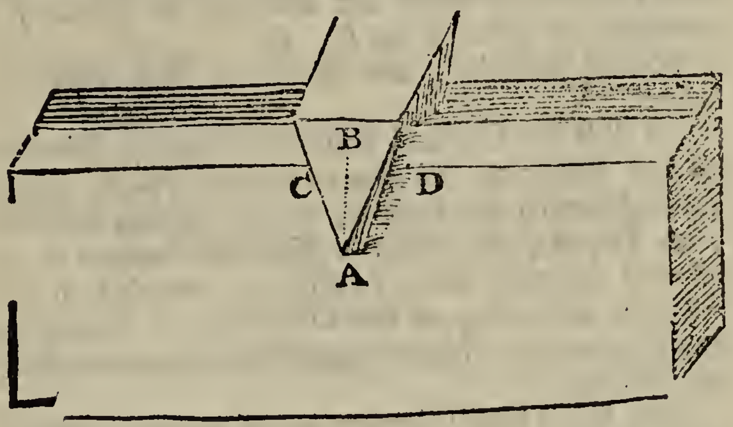
CULVERTAIL, [in *Carpentry*] the ſame with *Dovetail* ; which ſee.

CUN, or *Cond*, a Sea-Term, ſignifying to direct or guide. To cun a Ship, is, to direct the Perſon at Helm how to ſteer her. See *Cond.*

CUNEIFORME *Os*, is a Bone ſo called from the Reſemblance which it hath to a Wedge ; by the Ancients called *Multiforme*, by reaſon of the various Proceſſes on the Inſide and Outſide, which renders it rough and unequal. It is ſituate in the midſt of the Baſis of the Brain, and is placed under it like a Baſis, ſo that it touches upon moſt of the Bones of the Head, and of the Upper-Jaw. *Blanchard.*

CUNEIFORMIA *Oſſa*, are thoſe Bones of the *Tarſus* of the Foot which are accounted the Fourth, Fifth, and Sixth ; and theſe are ſo called, becauſe they are large above, and narrow below, like Wedges : They link all Three at the Side of one another, having their upper Part convex, and their lower concave, by which means the Muſcles and Tendons in the Sole of the Foot are not hurt when we go. At one End, each hath a *Sinus*, receiving the *Os Naviculare* ; and at the other End, they are joined to the three inner Bones of the *Metatarſus* : the inmoſt of theſe Bones is the largeſt, and the middle one the leaſt.

CUNEUS. The *Wedge*, one of the five mechanical Powers, is in the Form of a Priſm, whoſe Top and Sides are Parallelograms, but its Ends Iſoſceles Triangles ; whoſe Altitude is called the *Altitude of the Wedge*, as the Baſe of each ſaid Triangle is the *Thickneſs of the Wedge*. The right Line connecting the Vertices of the two Triangles, is called the *Edge* ; as the Parallelogram which joins their Baſes is called its *Dorſum*, or *Back*.



The Power of this Engine is eaſily eſtimated ; and is (when directly applied to the Top or Dorſum of the Wedge) to the Reſiſtance to be overcome, as the Thickneſs of the Wedge is to its Altitude. In the Figure B A is the Way of Power, and C D the Way of the Impediment or Reſiſtance: So that while the Wedge is driven down into the Wood, &c. by its whole Altitude, the Wood is divided by the entire Thickneſs of the Wedge, and this every where porportionably, as follows from the Nature of a triangular Figure. Wherefore a Wedge, whoſe Thickneſs is to its Altitude or Length in a little greater Porportion, than as the Power applied is to the Reſiſtance or Tenacity of the Wood; will cleave or divide it.

CUPPEL, or *Coppel*, an Inſtrument [in *Chymiſtry*] in the Form of a Diſh, made of Aſhes well waſh'd (to cleanſe them from all their Salt) or of Bones throughly calcined : Its Uſe is, to try and purify Gold and Silver ; which is done by mingling Lead with the Metal, and ſo expoſing it in the Coppel, to a violent Fire a great while : The Impurities of the Metal will then be carried off in Droſs, which Droſs is called *Litharge* of either Gold or Silver. 'Tis, by the Refiners, uſually called, a *Teſt*.

CUPPING-GLASSES. See *Cucurbitula.*

CUPOLA, CUPULO, [in *Architecture*] is an arched Room or Turret ſtanding on the very Top of a Dome or great Building, in Form either circular or polygonal ; ſome call it a *Lanthorn*.

CURATIO, is a right Way or Method of finding out by Symptoms and Indications, proper Remedies for any Diſeaſe, in order to the Recovery of Health. *Blanchard.*

CURATOR, [in the *Civil Law*] is a Perſon regularly appointed to take care of another ; as ſuppoſe of a Minor, by his Conſent from 24 Years of Age to 35 ; on the Determination of a Trial at Law, where the Magiſtrate may appoint a Curator for the Minor. The Magiſtrate alſo might appoint a Curator for a Madman, a Prodigal, deaf or dumb Perſon, as alſo for the Eſtates of Debtors, and of Perſons dying without Heirs.

CURCULIO, the ſame with *Clon.*

CURIA, a Word uſed formerly in different Senſes. Sometimes it ſignified the Perſons or Feudatory Tenants, who did their Suit and Service at the Court of the Lord. *L.*

Sometimes it ſignified a Houſe, as *Curia Canonicorum*, the Convent or Conventional Houſe; *Curia Perſonæ Eccleſiæ*, the Parſonage Houſe; and ſometimes it was uſed for the Service itſelf, of coming to the Court of the Lord, *Curiæ adventus.* Dr. *Kennet.*

CURIA *aviſare vult*, is a Deliberation that the Court intends to take upon any Point or Points of a Cauſe, before Judgment be reſolved on. *L.*

CURIA *Claudenda*, is a Writ that lieth againſt him that ſhould fence and cloſe up his Ground, if he refuſe or defer to do it. *L.*

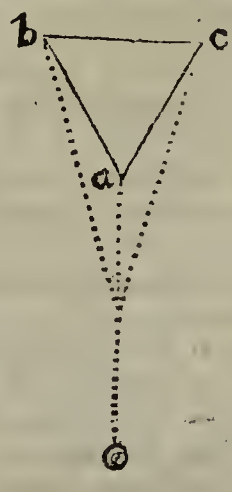
CUIRASSIERS, are Horſemen that wear Armour.

CURRENTS, are certain progreſſive Motions of the Water of the Sea in ſeveral Places, either quite down to the Bottom, or to a certain determinate Depth; by which a Ship may happen to be carried forward more ſwiftly, or retarded in her Courſe, according to the Direction or Setting of the Current in, with, or againſt the Courſe or Way of the Ship.

The firſt Thing therefore to be known, is, which Way the Current ſets; and if its Motion be ſwift, great and ſtrong, this will be beſt diſcovered by keeping an exact Account of the Ship's Way both outward and homeward, according to the beſt Method of what the Seamen call their *Dead Reckoning*, being very curious in obſerving the Way the Ship makes by the Log-line; for 'tis not the correct Account, but the Dead Reckoning, that muſt here aſſiſt you. Therefore you muſt be very careful to obſerve how the Ship goes by it, when you ſail near the Meridian, how ſhe is drawn from her Courſe; as alſo, when ſhe is ſteered directly Eaſt and Weſt, take good Notice whether ſhe alter her Latitude.

As for thoſe Gueſſes by the Ripplings of the Water, and by the Driving of Froth, *&c.* along ſhore, when you are in Sight of it, they will be of little Uſe. But the moſt uſual and the moſt uſeful Way of obſerving the Setting of a Current is thus:

When there is a ſmooth Sea, and not much Wind, heave out the Boat, with three or four Hands in her, together with a Compaſs, a Log-line, and Half-minute Glaſs, with alſo a Line or ſmall Warp of about an hundred Fathoms long; to the End of which Line faſten a triangular Piece of Board, as *a b c*, and to one of the Angles faſten a good heavy Piece of Lead to ſink it. Some uſe inſtead of this Board a Kettle tied by the Bail (which may do tolerably well).



When you are off from the Ship, caſt over your Board or Kettle, letting it ſink at leaſt 60 Fathom; and if you have Line enough, let it down 100 or 120 Fathom; then belaying the Line faſt about her Stern, it will bring her up, and make her ride as if ſhe were at Anchor. Then caſt over your Log, turn up the Glaſs, and as you veer out the Log-line, ſet the Drift of the Log with your Compaſs; ſo ſhall you know whether there be any Current or no; and if any, how it ſets; as alſo the Rate of its driving: Only remember to add always to the Drift, if the Line ſhe ride be of 60 Fathom, $\frac{1}{3}$ Part; if of 80 Fathom, $\frac{1}{4}$; if of 100 Fathom, the $\frac{1}{5}$ Part, *&c.* of the Drift more, for the Drift of the Boat; for though the Boat may ſeem to ride or lie ſtill, yet ſhe is found by Experience to drive at the ſame time.

N. B. Whether theſe Allowances be the very Truth, or not, I cannot ſay: They are ſaid to agree with Experience, and therefore may be uſed till better Obſervations of theſe Things may be made. Only this is certain, that the bigger the Board and Weight is that the Boat is to ride by, the leſs will be her Drift. *Sir* J. Moor's *Navig.*

If a Current ſet exactly with the ſame Direction as is the Courſe of the Ship, then it muſt augment her Motion forward in Proportion to the Velocity of the Drift.

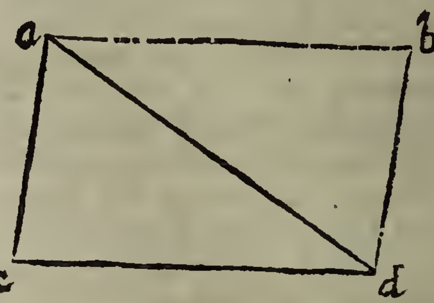
As if a Ship ſail N. N. E. 20 Miles, in a Current ſetting the ſame Way, and in the ſame Time eight Miles, her true Courſe will be N. N. E. 28 Miles in the ſame Time.

But if the Current ſet directly againſt the Ship's Courſe, it will abate of her Motion forward in Proportion to the Velocity of the Drift.

As if a Ship ſail N. E. 49 Miles in a Current, ſetting S. W. 10 Miles in the ſame time; the Ship's Courſe, or Diſtance, run in that Time, will be but 39 Miles: So if a Ship ſail N. E. 49 Miles in a certain Time, in a Current that ſets S. W. 59 Miles, in the ſame time; her true Courſe will be S. W. 10 Miles; that is, ſhe will fall Aftern 10 Miles in that Time.

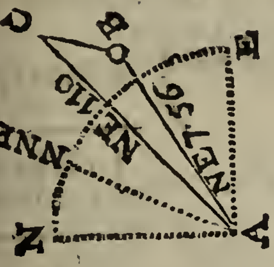
But if a Ship ſail acroſs any Current, her Motion will be compounded with that of the Current, and her Velocity augmented, or retarded proportionably to the Angle of her Direction, with that of the Direction of the Current, according as ſhe goes in part with it or againſt it.

As ſuppoſe the Ship's Courſe were from *a* to *c*, and the ſetting of the Current from *a* to *b*, the Ship will, by the Compoſition of thoſe two Motions be carried from *a* to *d*, in the Diagonal *a d.* See *Compoſition of Motion.*



Wherefore if a Ship ſails N. E. 110 Miles, in a Current which ſets S. W. 30 Miles in the ſame time, and her true Courſe and Diſtance ſailed be required, you may proceed thus:

1ſt. Geometrically.



1. Set off 4 Points from N. towards E. and draw AC equal to 110 Miles.

2. From C draw CB, parallel to the Line N.N.E. and equal to 30 Miles.

3. Draw AB, which will be the Ship's true Courſe, to find which

Trigonometrically,

In the Triangle ABC, there is

Given AC 110; ∠ at C 22 30; BC 30 — and it will be by Caſe 4. Sect. 4.

A+CBC : AC—BC :: t, ½∠A+B : t, ½∠B—A, *i. e.*

As the Sum of AC and BC 140	2.1461280
To their Difference 80	4.9030900
So is the Tangent of 78° 45′	10.7013382
To the Tangent of 70 49	10.4583002

Now 78° 45′—70° 49′ = 7° 56′ = ∠CAB.

Hence it appears that her true Courſe is NE 7° 56′ Eaſterly.

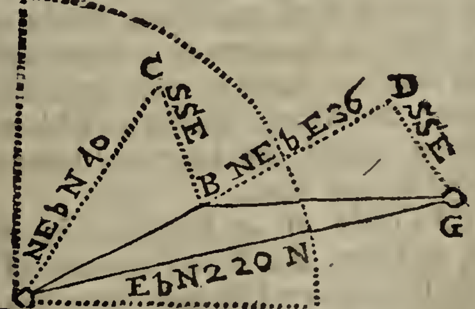
But for her Diſtance it will be by Caſe 1. Sect. 4.

s, ∠A : BC :: s, ∠C : AB. *i. e.*

As the Sine of the Angle at A 7° 56′	9.1399445
To the Drift of the Current BC 30	1.4771212
So is the Sine of the Angle at C 22° 30′	9.5828397
To the Diſtance run 83, 2 Miles	1.9200164

Ex. 2. If a Ship from the Latitude 36° 30′ S ſails NE by N 40 Miles, then NEbE 36 Miles, in a Current that ſets SSE 20 Miles in the Time that the Ship ſails 38 Miles, and it be required to find the direct Courſe and Diſtance between the Ship and her firſt Place, as alſo the Latitude the Ship is in.

1ſt. Having conſtructed it, as in the former.



In the Triangle ACB, are

Given AC 40; ∠ at C 56°, 15′; BC 21, 05 — To find AB, and the Angles at A and B.

It will be, by Caſe the 4th of Sect. the 4th.

AC+BC : AC—CB :: t, ½∠A+∠B : t, ½∠B—∠A; *i. e.*

As the Sum of AC and BC 61, 05	1.7856857
To their Difference 18, 95	1.2776092
So is the Tangent of 61°, 52½′	10.2720432
To the Tangent of 30, 08½	9.7639667

Now, 61°, 52½′ — 30°, 08½′ = 31°, 44′ = ∠CAB; therefore the Ship's firſt Courſe is NE by E 9°, 14′, Eaſtwardly.

For the Diſtance, it will be, by Caſe the 1ſt of Sect. the 4th,

s, CAB : CB :: s, ACB : AB; that is,

As the Sine of the ∠ CAB 31°, 44′	9.7209581
To CB the Drift of the Current 21, 05	1.3232521
So is the Sine of the ∠ at C 56°, 15′	9.9198464
To the Diſtance run, 33, 28	8.5221404

2. In the Triangle BDG, are

Given BD 36; ∠ at D 78°, 45′; DG 18, 95 — To find BD, and the ∠s DBG and DGB.

Wherefore,

As the Sum of BD and DG 54, 95	1.7399677
To their Difference 17, 05	1.2317244
So is the Tangent of 50°, 37′	10.0856980
To the Tangent of 20°, 42′	9.5774547

Hence the Angle DBG, will be found 29°, 55; wherefore the Ship's ſecond Courſe is E by N 7°, 25′ Eaſtwardly, and conſequently the Angle ABG = 159°, 19′.

But for BG, the Diſtance run, it will be

As the Sine of the Ang. BDG 29°, 55′	9.6978747
To DG the Drift of the Current, 18, 95	1.2776092
So is the Sine of the Ang. BDG 78°, 45	9.9915739
To BG the Diſtance run, 37, 27	1.5713090

3. In the Triangle ABG, are

Given AB 33, 28; ∠ABG 159°, 10′; BG 37, 27 — Whence muſt be found ∠ BAG and AG, and 'twill be,

As the Sum of AB and BG 70, 55	10.8484970
To their Difference 3, 99	0.6009729
So is the Tangent of 10°, 20½′	9.2612203
To the Tangent of 00°, 36′	8.0136962

Hence the Angle BAG is 10°, 56′, and conſequently the bearing of the Ship from her firſt Port is E by N. 2°, 20′ Northerly; and for the Diſtance it will be,

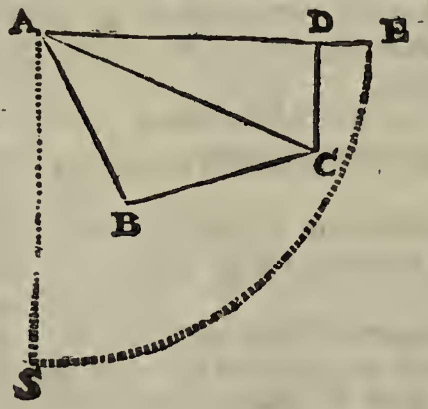
As the Sine of the Angle BAG 10°, 56′	9.2789911
To the Dſtance run BG 37, 27	1.5713090
So is the Sine of the ∠ ABG 159°, 19′	9.5480240
To the Diſtance between the Ship and her Port 69, 24	1.8403419
Now for the Difference of Latitude, it will be as the Radius	10.0000000
To the Diſtance ſailed, 69, 24	1.2403571
So is the Co-ſine of the Courſe, 76°, 25′	9.3708079
To the Difference of Latitude 16, 26	1.2111650

Hence, becauſe ſhe ſailed from a South Latitude		Nly
From the Latitude ſhe ſailed from	36°, 30′	Sly
Take the Difference of Lat. made	$16\frac{1}{3}'$	Nly
Remains the Lat. the Ship is in	$36^\circ, 13\frac{2}{3}$	Sly

Admit a Ship, from a certain Head-line, in the Latitude of 34°, 00′ North, ſails S E by S 24 Miles in 6 Hours, in a Current that ſets between the North and the Eaſt; and then the Cape is found to bear W N W, and the Ship to be in the Lat. of 33°, 45′ North: I demand the Setting and Drift of the Current?

Geometrically,

1. Set off three Points from S towards E, and draw the Line A B equal to 24 Miles.



2. Set off two Points from E towards S, and draw the Line A C.
3. At the Diſtance of 15 Miles, equal to the Difference of Latitude, draw a parallel to A E, till it interſect A C as in C.
4. From the Interſection C, draw C D parallel to A S; alſo the Line B C the Drift and Setting of the Current.

To find which *Arithmetically.*

In the Triangle A D C, Right-angled at D, are

Given $\left\{\begin{matrix} DC\ 15 \\ \angle A\ 22^\circ, 30' \end{matrix}\right\}$ to find A C

Wherefore,

$S \angle A : DC :: R : AC$; that is,

As the Sine of the Angle at A 22°, 30′	9.5828397
To the Difference of Latitude 15	1.1760912
So is the Radius	10.0000000
To the Diſtance run 39, 2	1.5932515

Again, in the Triangle A B C, are

Given $\left\{\begin{matrix} AB\ 24 \\ \angle A\ 33^\circ, 45' \\ AC\ 39, 2 \end{matrix}\right\}$ to find $\left\{\begin{matrix} \angle C \\ BC \\ \angle B \end{matrix}\right.$

Wherefore,

$\overline{AB}+\overline{AC} : \overline{AC}-\overline{AB} :: t\,\tfrac{1}{2}\,\overline{\angle B}+\overline{\angle C} : t\,\tfrac{1}{2}\,\angle B-\angle C$

As the Sum of the Sum of the Sides A B and A C 63°, 2′	1.8007171
To their Difference 15°, 2′	1.1818436
So is the Tangent of $73^\circ, 07\frac{1}{2}'$	10.5180608
To the Tangent of $38^\circ, 24\frac{1}{2}'$	9.8991873

Which added to $73^\circ, 07\frac{1}{2}'$, gives 111°, 32′, the Angle at B. And hence the Current will be found to ſet E by N 00°, 58′ Northerly.

For B C, the Drift of the Current, it will be,

$s, \angle B : AC :: s, \angle A : BC$; that is,

As the Sine of the Ang. at B 111°, 32′	9.9685783
To A C the Diſtance run 39°, 2′	1.5932515
So is the Sine of the Ang. at A 33°, 45′	9.7447390
To B C the Drift of the Current in 6 Hours 23°, 41′	1.3694122

And conſequently it ſets at the Rate of 3°, 9′ Miles an Hour.

Several other Queſtions might be propoſed relating to Currents, but theſe being throughly underſtood, are ſufficient for the Purpoſe.

CURSITOR, is an Officer or Clerk belonging to the *Chancery*, that maketh out original Writs: They are called alſo *Clerks of the Courſe*; and there be of theſe Twenty-four in Number, which have allotted to each of them ſeveral Shires, in which they make out ſuch original Writs, as are by the Subject required, and are a Corporation of themſelves.

CURSOR, is a Piece or little Ruler or Label of Braſs being divided like a Line of Sines, and ſliding in a Groove or Notch along the Middle of another Label or Ruler, repreſenting the Horizon, and always at Right-angles to it: 'Tis uſed in the *Analemma*, which ſee.

CURTAIN, [in *Fortification*] is the Front of the Wall of a fortified Place between two Baſtions, or the longeſt ſtraight Line that runs about the Rampart, drawn from one Flank to the other, and bordered with a Parapet five Foot high, behind which the Soldiers ſtand to fire upon the Covert-way and into the Moat. Beſiegers ſeldom carry on their Attacks againſt the Curtain, becauſe 'tis the beſt flanked of any Part.

CURTATION *of a Planet*, [in *Aſtronomy*] according to ſome, is a little Part cut off from the Line of his Interval or Diſtance from the Sun.

CURTESY *of England.* See *Courteſy of England.*

CURVATURE, ſignifies Crookedneſs.

CURVATURE *of a Line*, is the peculiar Manner of its bending or Flexure, whereby it becomes a Curve of ſuch peculiar Properties. Thus the Curvature of the Circle is ſuch, that all Points of the Periphery are equally diſtant from one Point within, called the Centre. The Curvatures of different Circles are to one another reciprocally as their Radii.

CURVE, the ſame with Crooked.

CURVE, generating the Solid of leaſt Reſiſtance. See *Solid.*

CURVES, or *Curvilineal Figures*, are [in *Geometry*] ſuch as are terminated or bounded by curved or crooked Lines, as Circles and Ellipſes; and all Conick Sections, Spherical Triangles, *&c.* are Curves.

The incomparable Sir Iſaac Newton *gives this following Enumeration of Geometrical Lines of the Third or Cubick Order; in which you have an admirable Account of many Species of Curves which exceed the Conick Sections, for they go no higher than the Quadratick or Second Order.*

The Orders of Geometrick Lines.

1. Geometrical Lines are beſt diſtinguiſhed into Claſſes, Genders, or Orders, according to the Number of the Dimenſions of an Equation, expreſſing the relation between the Ordinates and the Abſciſſæ; or, which is much at one, according by the Number of Points in which they may be cut to a Right-line. Wherefore, a Line of the Firſt Order will be only a Right-line; thoſe of the Second or Quadratick Order, will be the Circle and the Conick Sections; and thoſe of the Third or Cubick Order, will be the Cubical and Nelian Parabola's, the Ciſſoid of the Antients, and the reſt as below enumerated. But a Curve of the Firſt Gender (becauſe a Right-line can't be reckoned among the Curves) is the ſame with a Line of the Second Order; and a Curve of the Second Gender, the ſame with a Line of the Third Order; and a Line of an Infiniteſimal Order, is that which a Right-line may cut in infinite Points, as the Spiral, Cycloid, the Quadratrix, and every Line generated by the infinite Revolutions of a Radius or Rota.

2. The chief Properties of the Conick Sections are every where treated of by Geometers; and of the ſame Nature are the Properties of the Curves of the Second Gender, and of the reſt, as from the following Enumeration of their principal Properties will appear.

3. For if any right and parallel Lines be drawn and terminated on both Sides by one and the ſame Conick Section; and a Right-line biſecting any two of them ſhall biſect all the reſt; and therefore ſuch a Line is called the *Diameter* of the *Figure*; and all the Right-lines ſo biſected, are called *Ordinate Applicates* to that Diameter, and the Point of Concourſe to all the Diameters is called the *Centre* of the *Figure*; as the Interſection of the Curve and of the Diameter, is called the *Vertex*, and that Diameter the *Axis* to which the Ordinates are normally applied. And ſo in Curves of the Second Gender, if any two right and parallel Lines are drawn occurring to the Curves in three Points; a Right-line which ſhall ſo cut thoſe Parallels, that the Sum of two Parts terminated at the Curve on one Side of the interſecting Line, ſhall be equal to the third Part terminated at the Curve on the other Side; this Line ſhall cut, after the ſame Manner, all others parallel to theſe, and occurring to the Curve in three Points; that is, ſhall ſo cut them, that the Sum of the two Parts on one Side of it, ſhall be equal to the third Part on the other.

And therefore theſe three Parts, one of which is thus every where equal to the Sum of the other two, may be called *Ordinate Applicates* alſo: And the interſecting Line to which the Ordinates are applied, may be called the *Diameter*; the Interſection of the Diameter and the Curve, may be called the *Vertex*; and the Point of Concourſe of any two Diameters, the *Centre.*

And if the Diameter be Normal to the Ordinates, it may be called the *Axis*; and that Point where all the Diameters terminate, the *General Centre.*

Aſſymptotes and their Properties.

4. The Hyperbola of the firſt Gender has two Aſſymptotes; that of the ſecond, three; that of the third, four; and it can have no more; and ſo of the reſt. And as the Parts of any Right-line lying between the Conical Hyperbola and its two Aſſymptotes are every where equal; ſo in the Hyperbola of the Second Gender, if any Right-line be drawn, cutting both the Curve and its three Aſſymptotes in three Points, the Sum of the two Parts of that Right-line being drawn the ſame way from any two Aſſymptotes to two Points of the Curve, will be equal to the third Part drawn a contrary way from the third Aſſymptote, to a third Point of the Curve.

Latera Tranſverſa & Recta.

5. And as in Non Parabolick Conick Sections, the Square of the Ordinate Applicate, that is, the Rectangle under the Ordinates, drawn at contrary Sides of the Diameter, is to the Rectangle of the Parts of the Diameter, which are terminated at the Vertex's of the Ellipſis or Hyperbola, as a certain given Line, which is called the *Latus Rectum*, is to that Part of the Diameter which lies between the Vertex's, and is called the *Latus Tranſverſum*; ſo in Non Parabolick Curves of the ſecond Gender, a Parallelopiped under the three Ordinate Applicates, is to a Parallelopiped, under the Parts of the Diameter terminated at the Ordinates, and the three Vertex's of the Figure in a certain given Ratio; in which Ratio, if you take three Right-lines to the three Parts of a Diameter ſituated between the Vertex's of the Figure, one anſwering to another; then theſe three Right-lines may be called the *Latera Recta* of the Figure, and the Parts of the Diameter between the Vertices, the *Latera Tranſverſa.* And as in the Conick Parabola, having to one and the ſame Diameter but one only Vertex, the Rectangle under the Ordinates is equal to that under the Part of the Diameter cut off between the Ordinates and the Vertex, and a certain Line called the *Latus Rectum*: So in the Curves of the ſecond Gender, which have but two Vertex's to the ſame Diameter; the Parallelopiped under three Ordinates, is equal to the Parallelopiped under the two Parts of the Diameter cut off between the Ordinates and thoſe two Vertex's, and a given Right-line, which therefore may be called the *Latus Rectum.*

The Ratio of the Rectangles under the Segments of Parallels.

Laſtly, As in the Conick Sections when two Parallels terminated on each Side at the Curve, are cut by two other Parallels terminated on each Side by the Curve, the firſt being cut by the third, and the ſecond by the fourth; as here the Rectangle under the Parts of the firſt, is to the Rectangle under the Parts of the third, as the Rectangle under the Parts of the ſecond, is to that under the Parts of the fourth: So when four ſuch Right-lines occur to a Curve of the ſecond Gender, each one in three Points; then ſhall the Parallelopiped under the Parts of the firſt Right-line, be to that under the Parts of the third; and as the Parallelopiped under the Parts of the ſecond Line, unto that under the Parts of the fourth.

Hyperbolick and Parabolick Legs.

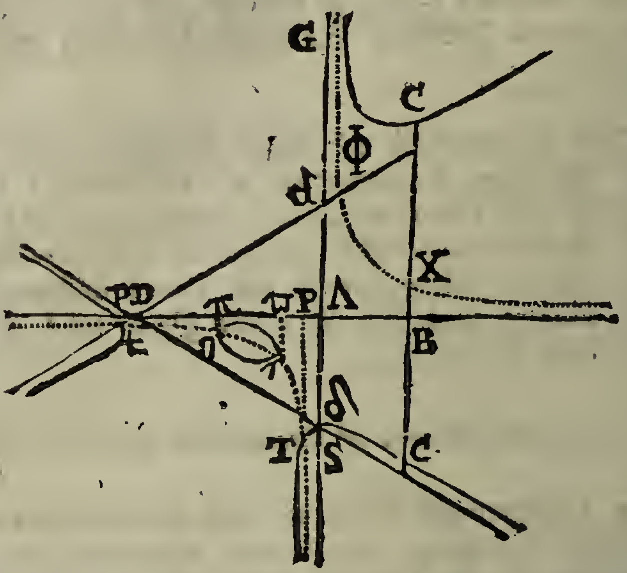
All the Legs of Curves of the ſecond and higher Genders, as well as of the firſt, infinitely drawn out, will be of the Hyperbolick or Parabolick Gender; and I call that an Hyperbolick Leg, which infinitely approaches to ſome Aſſymptote; and that a Parabolick one, which hath no Aſſymptote. And theſe Legs are beſt known from the Tangents: For if the Point of Contact be at an infinite Diſtance, the Tangent of an Hyperbolick Leg will coincide with the Aſſymptote, and the Tangent of a Parabolick Leg will recede *in infinitum*, will vaniſh, and no where be found. Wherefore the Aſſymptote of any Leg is found, by ſeeking the Tangent to that Leg at a Point infinitely diſtant: And the Courſe, Place, or Way of an infinite Leg, is found by ſeeking the Poſition of any Right-line, which is parallel to the Tangent where the Point of Contact goes off *in infinitum*: For this Right-line is directed towards the ſame Way with the infinite Leg.

The Reduction of all Curves of the Second Gender to four Caſes of Equations.

CASE I.

All Lines of the firſt, third, fifth, and ſeventh Order, and ſo of any one, proceeding in the Order of the odd Numbers, have at leaſt two Legs or Sides proceeding on *ad infinitum*, and towards contrary Ways. And all Lines of the third Order have two ſuch Legs or Sides running out contrary ways, and towards which no other of their infinite Legs (except in the *Carteſian* Parabola) do tend. If the Legs are of the Hyperbolick Gender, let GAS be their Aſſymptote; and to it let the parallel CB*c* be drawn, terminated (if poſſible) at both Ends at the Curve. Let this Parallel be biſected in X; and then will the Place of that Point X be the Conical Hyperbola Xφ, one of whoſe Aſſymptotes is AS: Let its other Aſſymptote be AB; then the Equation, by which the Relation between the Ordinate BC and the Abſciſſa AB is determined, if AB be put $=x$ and BC $=y$, will always be in this Form, $xyy + ey = ax^3 + bxx + cx + d$, where the Terms e, a, b, c, and d, denote given Quantities, affected with their Signs $+$ and $-$; of which any one may be wanting, ſo the Figure, through their Defect, don't turn into a Conick Section. And this Conical Hyperbola may coincide with its Aſſymptotes; that is, the Point X may come to be in the Line AB, and then the Term $+ey$ will be wanting.

Fig. 1.



CASE II.

9. But if the Right-line CB*c* cannot be terminated both ways at the Curve, but will occur to the Curve only in one Point, then draw any Line in a given Poſition, which ſhall cut the Aſſymptote AS in A; as alſo any other Right-line, as BC, parallel to the Aſſymptote, and meeting the Curve in the Point C: And then the Equation, by which the Relation between the Ordinate BC and the Abſciſſa AB is determined, will always put on this Form, $xy = ax^3 + bxx + cx + d$.

CASE III.

10. But if the oppoſite Legs are of the Parabolick Gender, draw the Right-line CB*c*, terminated at both Ends, if it's poſſible, at the Curve; and running according to the Courſe of the Legs, which biſect in B; then ſhall the Place of B be a Right-line. Let that Right-line be AB, terminated at any given Point, as A; and then the Equation by which the Relation between the Ordinate BC and the Abſciſſa AB is determined, will always be in this Form, $yy = ax^3 + bxx + cx + d$.

CASE IV.

11. But if the Right-line CB*c* meet the Curve but in one Point, and therefore can't be terminated at the Curve at both Ends; let the Point where it occurs to the Curve be C, and let that Right-line at the Point B, fall on any other Right-line given in Poſition, as AB, and terminated at any given Point, as A; then will the Equation, by which the Relation between the Ordinate BC and the Abſciſſa Aβ is determined, always be in this Form, $yy = ax^3 + bxx + cx + d$.

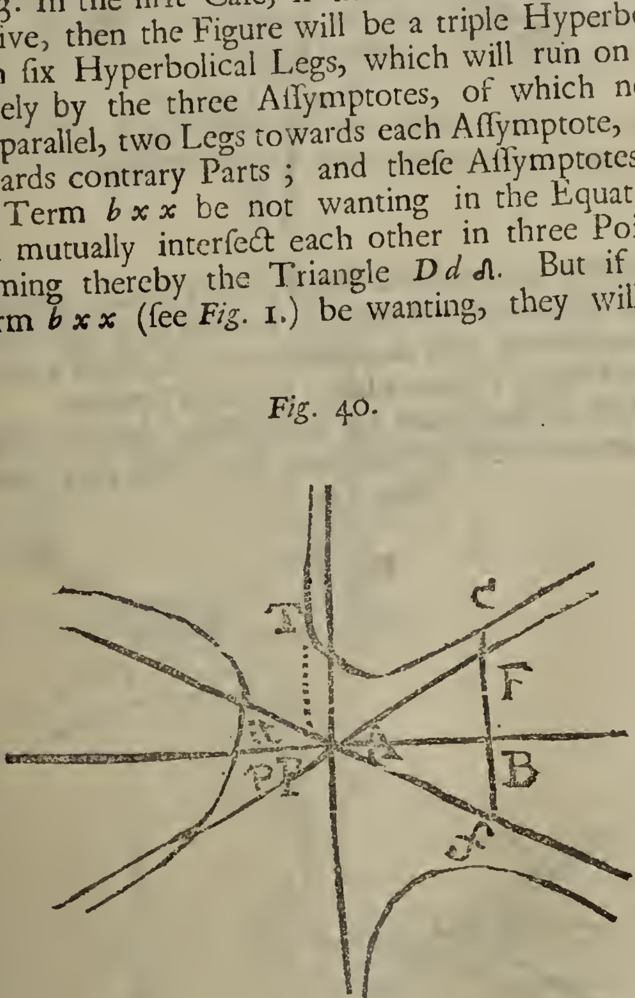
The Names of the Forms.

12. In the Enumeration of Curves of theſe Caſes, we call that an *Inſcribed Hyperbola*, which lies entirely within the Angle of the Aſſymptotes, like the *Conical Hyperbola*; and that a *Circumſcribed* one, which cuts the Aſſymptotes, and contains the Parts cut off within its own proper Space; and that an *Ambigenial* one, which hath one of its infinite Legs inſcribing it, and the other circumſcribing it. I call that a *Converging* one, whoſe concave Legs bend inwards towards one another, and turn both the ſame way; but that I call a *Diverging* one, whoſe Legs turn their Convexities towards each other, and tend towards quite contrary ways. I call that *Hyperbola contrary-leg'd*, whoſe Legs are convex towards contrary Parts, and run infinitely on towards contrary ways; and that a *Conchoidal* one, which is applied to its Aſſymptote with its concave Vertex and diverging Legs; and that an *Anguineal* or *Eel-like* one, which cuts its Aſſymptote with contrary Flexions, and is produced both ways into contrary Legs. I call that a *Cruciform* or *Croſs-like* one, which cuts its Conjugate croſs-ways; and that *Nodate*, which, by returning round into, decuſſates itſelf. I call that *Cuſpidate*, whoſe two Parts meet and terminate in the Angle of Contact; and that *Punctate*, whoſe oval Conjugate is infinitely ſmall, or a Point: And that Hyperbola I call *Pure*, which, by the Impoſſibility of its two Roots, is without any Oval-Node, Spike, or Conjugate Point. And in the ſame Senſe I denominate a Parabola alſo, to be *Converging*, *Diverging*, *Contrary-leg'd*, *Cruciform*, *Nodate*, *Cuſpidate*, *Punctate*, and *Pure*.

Of the redundant Hyperbola and its Aſſymptotes.

13. In the firſt Caſe, if the Term $a x^3$ be affirmative, then the Figure will be a triple Hyperbola, with ſix Hyperbolical Legs, which will run on infinitely by the three Aſſymptotes, of which none are parallel, two Legs towards each Aſſymptote, and towards contrary Parts; and theſe Aſſymptotes, if the Term $b x x$ be not wanting in the Equation, will mutually interſect each other in three Points, forming thereby the Triangle $D d \delta$. But if the Term $b x x$ (ſee *Fig.* 1.) be wanting, they will all converge to the ſame Point. In the former Caſe, take $A D = \frac{-b}{2a}$, and $A d = A \delta = \frac{b}{2\sqrt{d}}$, and join $D d$, $D \delta$; ſo ſhall $A D$, $D d$, and $D \delta$, be the three Aſſymptotes. In the latter Caſe, draw any Ordinate, as $B C$, in which, both ways produced, take, on each Side, $B F$ and $B f$, equal to one another, and in the ſame Ratio with $A B$, that $\sqrt{a}$ hath to I; and then joining $A F$, $A f$; $A B$, $A F$, and $A f$, ſhall be three Aſſymptotes. And this kind of Hyperbola I call *Redundant*, becauſe it exceeds the Conick Sections in the Number of its Hyperbolick Legs.

Fig. 40.



Of the Diameter of this Hyperbola, and the Poſition of its infinite Legs.

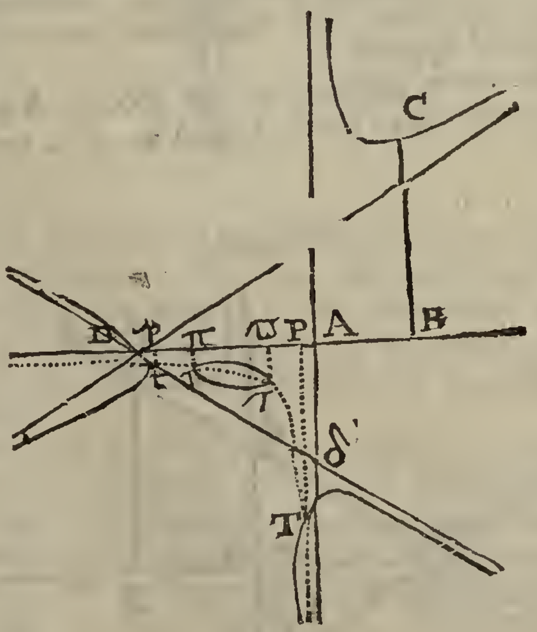
14. In every *Redundant Hyperbola*, if neither the Term $e y$ be wanting, nor $b b - 4 a c$ equal to $\mp a e \sqrt{:a}$, the Curve will have no Diameter; but if either of thoſe happen, it will have one only Diameter, and three if they both happen. And the Diameter will always paſs thro' the Interſection of two of the Aſſymptotes, and biſect all Right-lines which are terminated each way by thoſe Aſſymptotes, and which are parallel to the third Aſſymptote: And the Abſciſſa AB will be the Diameter of the Figure, as often as the Term $e y$ is wanting. I take the Word *Diameter* here, and in the following Pages, abſolutely; and in the common Acceptation of it, *viz.* for an Abſciſſa which hath every where two equal Ordinates, one on each Side, inſiſting at the ſame Point.

Nine Redundant Hyperbola's, having no Diameter, but three Aſſymptotes, which form a Triangle.

15. If the Redundant Hyperbola have no Diameter, let the four Roots or Values of x in this Equation $a x^4 + b x^3 + c x x + d x + \frac{1}{4} e e = 0$, be ſought: And ſuppoſe them to be A P, A ϖ, A π, and A p. Let the Ordinates P T, $\varpi \tau$, ϖ 𝔗, and $p t$, be erected, and thoſe ſhall touch the Curve in the Points T, τ, 𝔗, t, and by that Contact ſhall give the Limits of the Curve, by which its Species will be diſcovered.

For if all the Roots, A P, A ϖ, A π, A p, (ſee *Fig.* 1.) are real, having the ſame Sign, and are unequal; the Curve conſiſts of three Hyperbola's, (an *Inſcribed*, a *Circumſcribed*, and an *Ambigenial* one) with an Oval: And one of the Hyperbola's will lie towards D, another towards d, and the third towards δ; and the Oval will always lie within the

Fig. 2.



Triangle D d δ, and alſo within the middle Limits, 7 and τ, where it will be touch'd by the Ordinates, π 7 and ϖ τ. And this is the firſt Species.

But if either the two greateſt Roots, A π, A p; or the two laſt, A P, A ϖ, are equal to one ano-

Fig. 3.

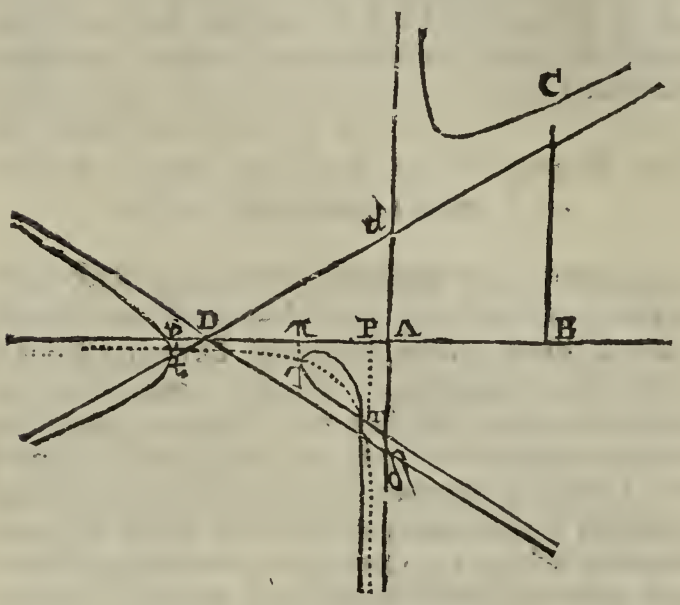
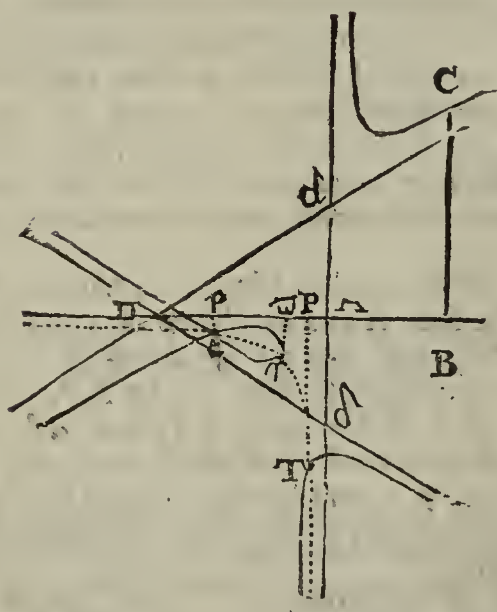


Fig. 4.



ther, and have the ſame Sign with the other two; then the Oval and Circumſcribed Hyperbola will join with one another, the Points of Contact 7 and t, or T and τ, coinciding; and the Legs of the Hyperbola decuſſating one another, will be continued in the Oval, and make the Nodate Figure. The ſecond Species.

If the three greateſt of the Roots, A p, A π, A ϖ; or the three leaſt, A π, A ϖ, A P, are equal

Fig. 5.

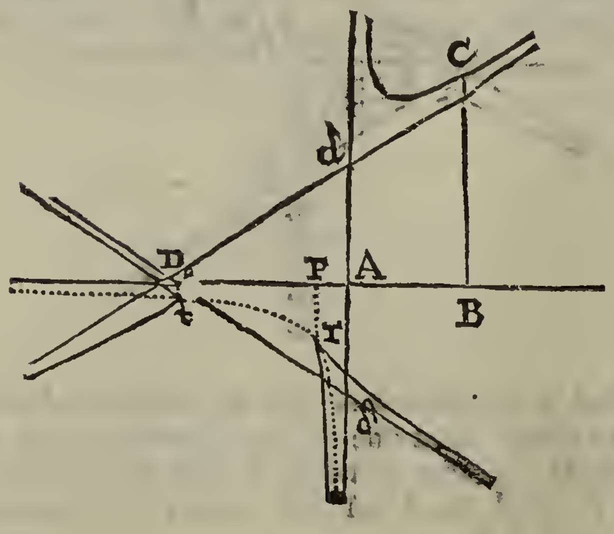
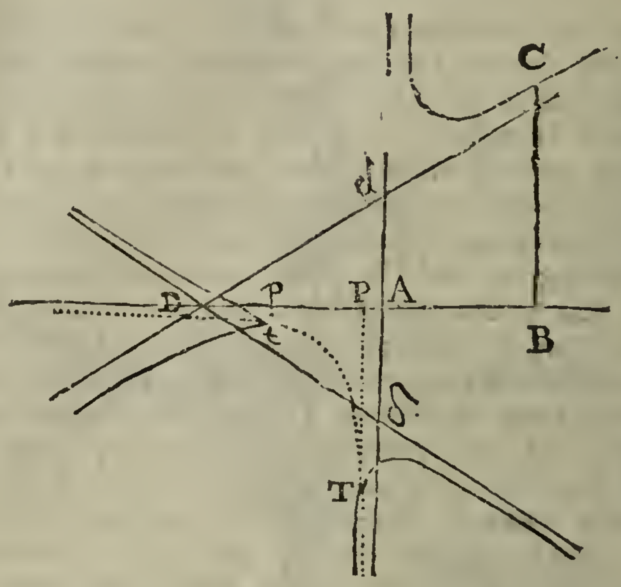


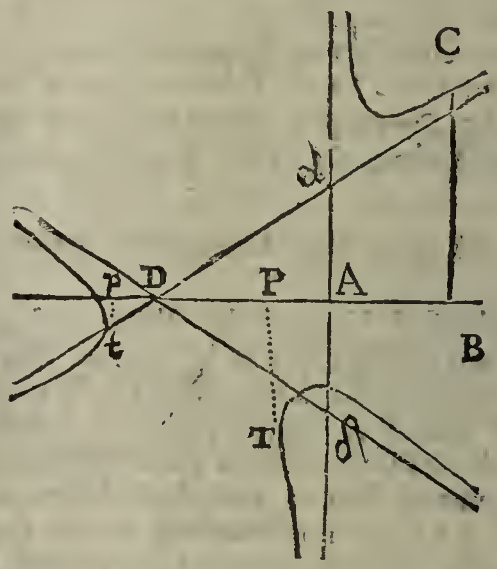
Fig. 6.



to one another, the Nodus will be turned into a very ſharp *Cuſpis*; for the two Legs of the circumſcribed Hyperbola's will then concur in the Angle of Contact, and not be produced further. And this is the third Species.

If the two middle Roots, A ϖ and A π, are equal, the Points of Contact, τ and 7, will be coincident;

Fig. 7.

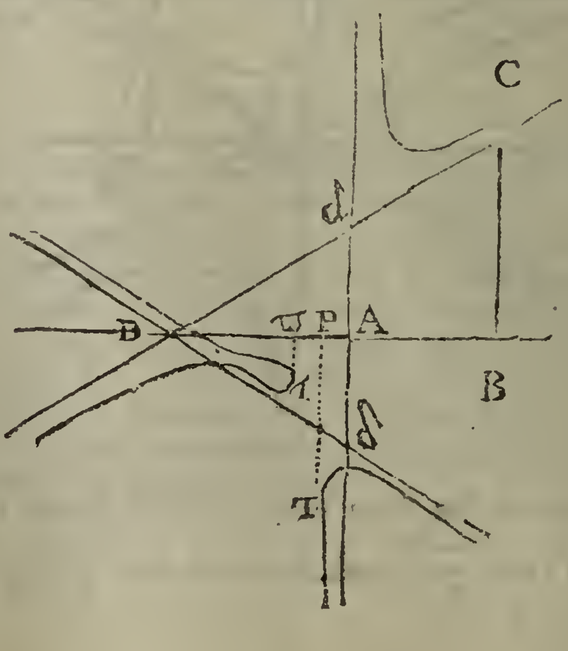


wherefore the Oval will vaniſh into a Point, and the Figure will conſiſt of three Hyperbola's, an *Inſcribed*, a *Circumſcribed*, and an *Ambigenial* one, with a conjugate Point: Which makes a fourth Species.

If two of the Roots are impoſſible, and the other two unequal, and of the ſame Sign, (for they can't

(See *Fig.* 7.)

Fig. 8.



have

Fig. 13.

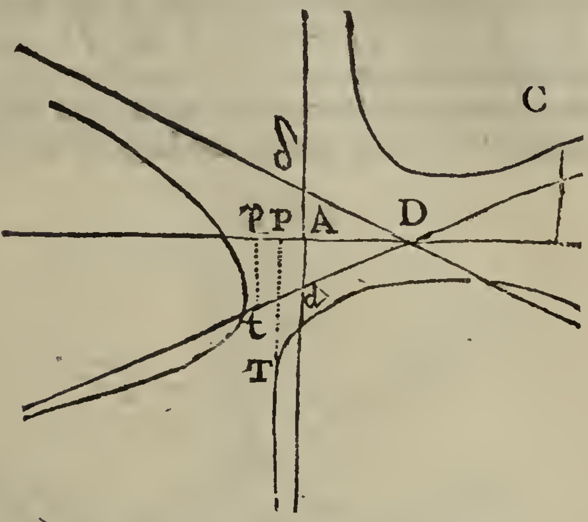
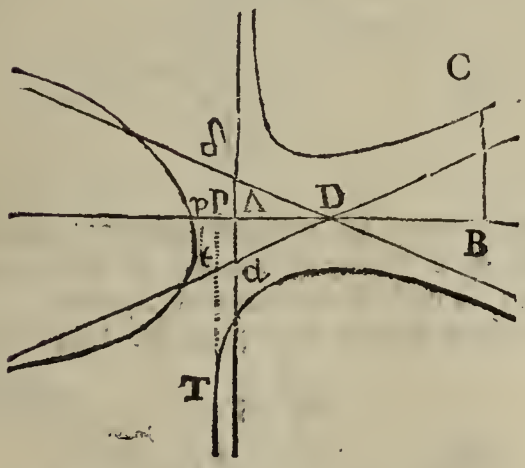


Fig. 14.



have contrary Signs); there will be three pure Hyperbola's, without any Oval, Node, Cuſp, or Point Conjugate; and theſe Hyperbola's will either lie at the Sides or the Angles of the Triangle made by the Aſſymptotes: Which makes a fifth or ſixth Species.

If two of the Roots are equal, and the other two either impoſſible or real, with Signs contrary to thoſe of the equal Roots; the Cruciform Figure will be produced: For two of the Hyperbola's will decuſſate one another; and that either at the Vertex of the Triangle made by the Aſſymptotes, or at its Baſe; and theſe two are the ſeventh and eighth Species.

Fig. 9.

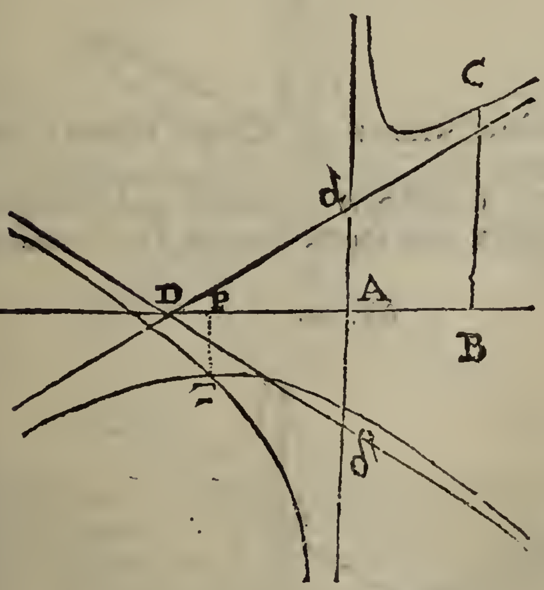


Fig. 10.

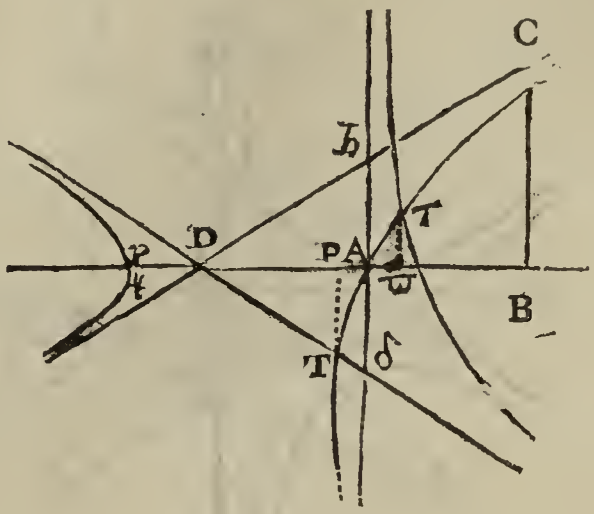


Fig. 15.

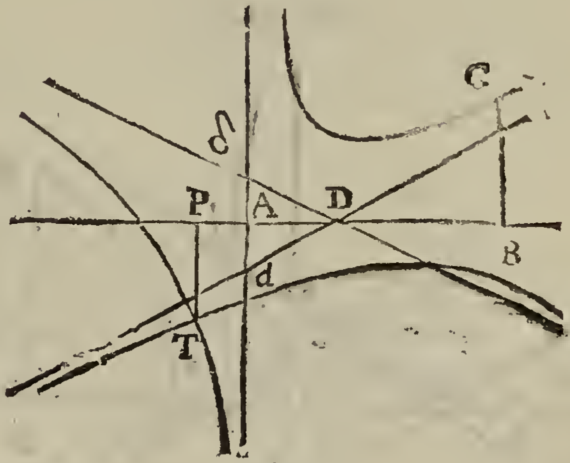
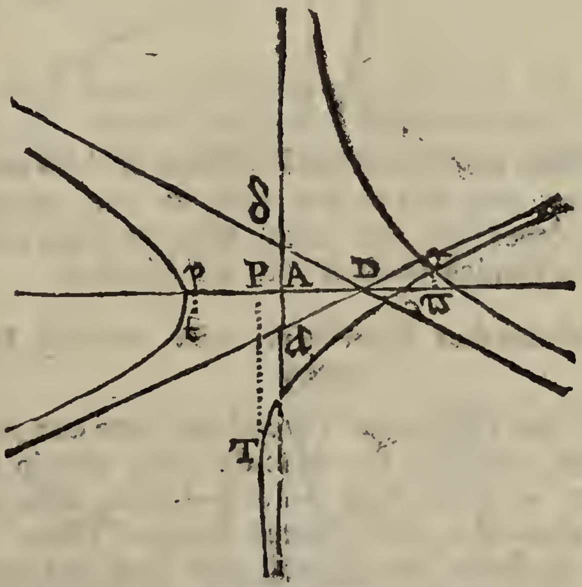


Fig. 16.



Laſtly, If all the Roots are impoſſible, or if they are all real and unequal, and two of them are affirmative, and two negative; then there will be two Hyperbola's at the oppoſite Angles of the two Aſſymptotes, with an Anguineal or Serpentine Hyperbola about the third Aſſymptote. Which is the ninth Species.

Fig. 11.

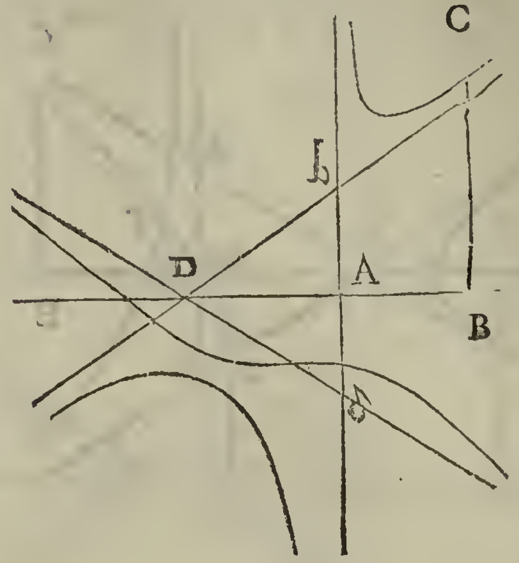
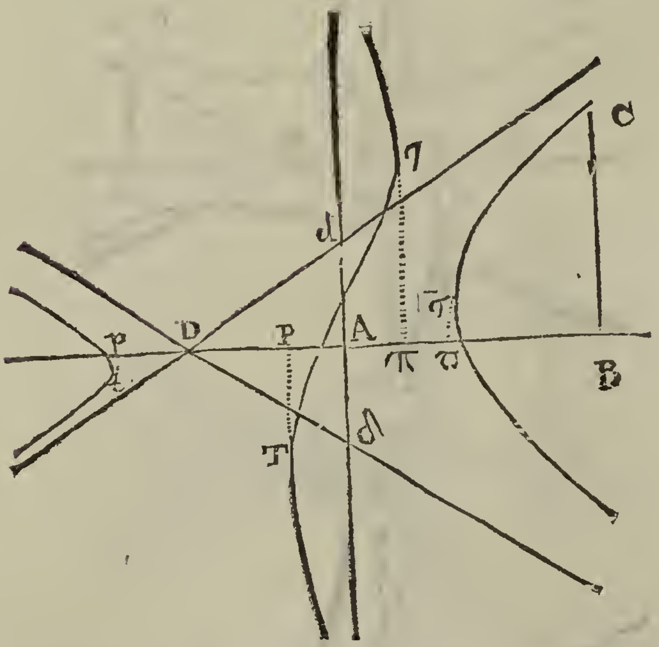


Fig. 12.



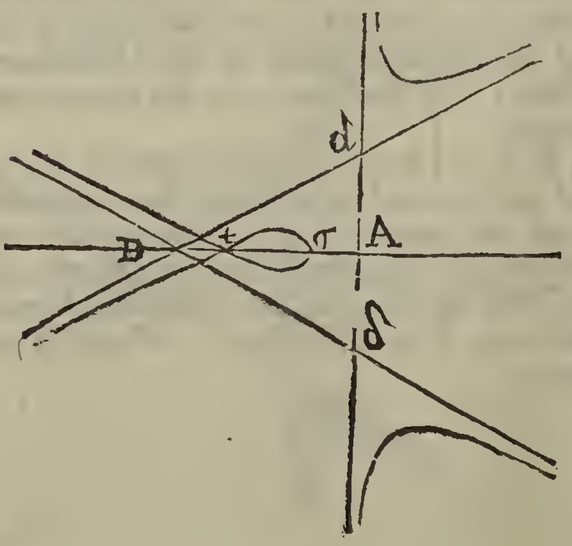
And theſe are all the poſſible Caſes of the Roots; for if any two Roots are equal to one another, and the other two are equal alſo, the Figure will become a Conick Section with a Right-line.

Twelve Redundant Hyperbola's, with one only Diameter.

16. If the Redundant Hyperbola have one only Diameter, let it be the Abſciſſa A B; and in the Equation $a x^3 + b x x + c x + d = 0$, ſeek the three Values of x, or the three Roots. Then,

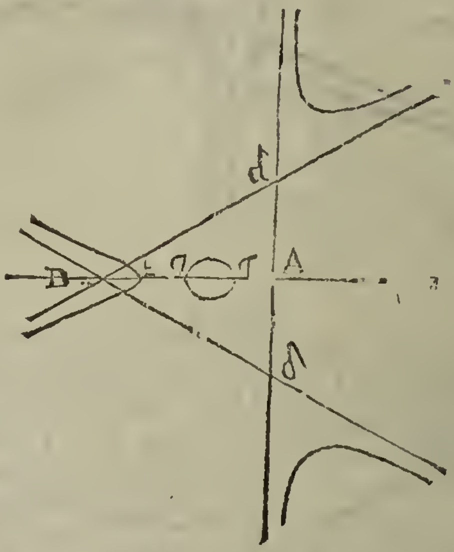
If thoſe Roots are all real, and have the ſame Sign, the Figure ſhall conſiſt of an Oval lying within the Triangle D *d* δ, and of three Hyperbola's as its Angles; *viz.* one circumſcribed at the Angle D, and the other two inſcribed at *d* and δ; and this makes a tenth Species.

Fig. 17.



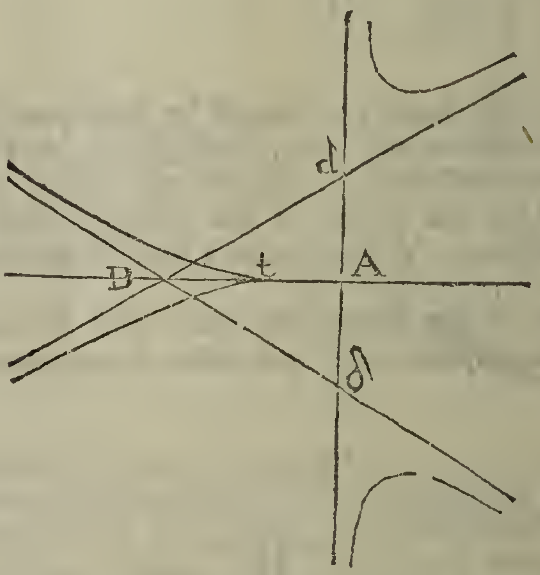
If the two great Roots are equal, and the third of the ſame Sign with them, the Legs of the Hyperbola lying towards D, will decuſſate one another in the Form of a Node, by Reaſon of the Contact of the Oval: Which is the eleventh Species.

Fig. 18.



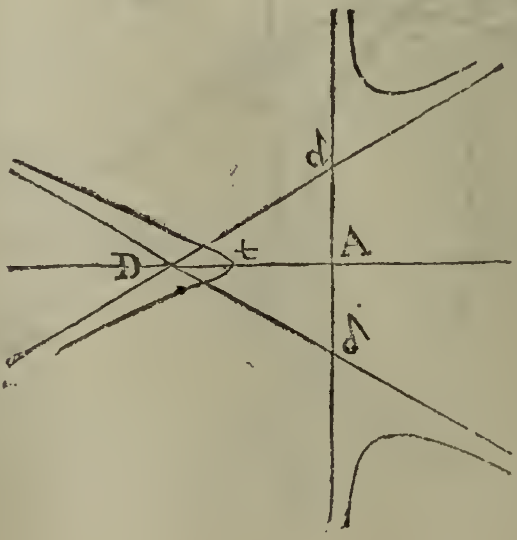
If the three Roots are equal, the Hyperbola becomes cuſpidate, without any Oval: Which is the twelfth Species.

Fig. 19.



If the two leaſt Roots are equal, and the third of the ſame Sign with them, then the Oval vaniſhes

Fig. 20.



into a Point. Which makes a thirteenth Species.

In the four laſt Species, the Hyperbola lying towards D, contains its Aſſymptote within it; but the other two are themſelves contained within the Aſſymptotes.

If two of the Roots are impoſſible, then there will be three pure Hyperbola's, without any Oval, (See *Fig.* 20.) Decuſſation, or Cuſpis. And there are four Caſes of this Species, *viz*, a *Fourteenth*, if the circumſcribed Hyperbola lie towards D; and a *Fifteenth*, if the inſcribed Hyperbola lie towards D; a *Sixteenth*, if the circumſcribed Hyperbola lie under the Baſe D δ of the Triangle D *d* δ, and a *Seventeenth*, when the inſcribed Hyperbola lies under the ſame Baſe.

Fig. 21.

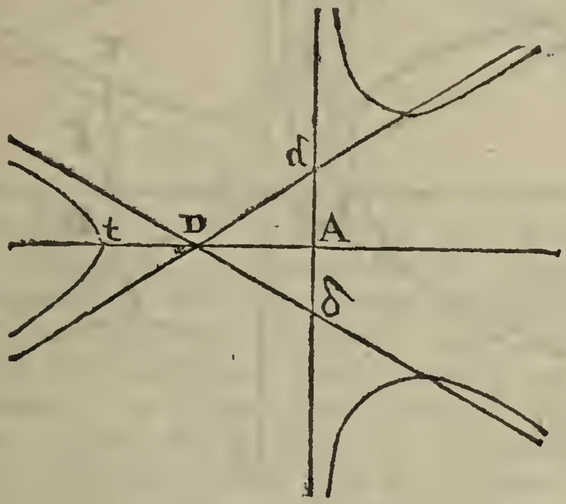


Fig. 22.

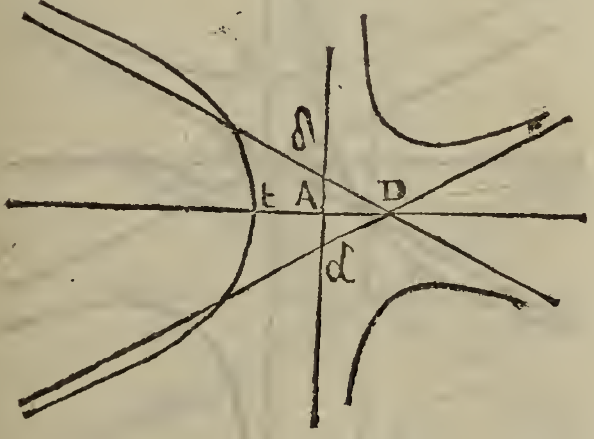
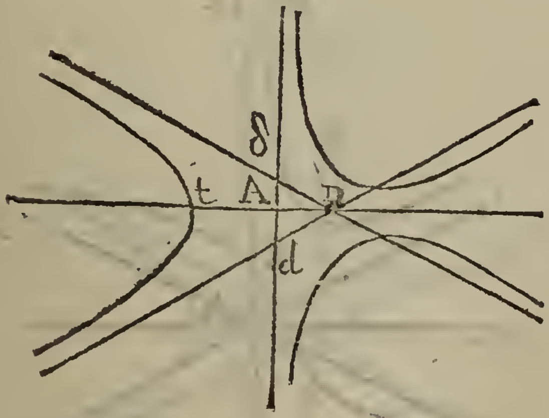


Fig. 23.



If two Roots are equal, and the third of a different Sign from them, the Figure will be Cruciform; for two of the three Hyperbola's will decuſſate one another, either at the Vertex, or at the Baſe of the Triangle made by the Aſſymptotes: Which two Species are the Eighteenth and Nineteenth.

Fig. 24.

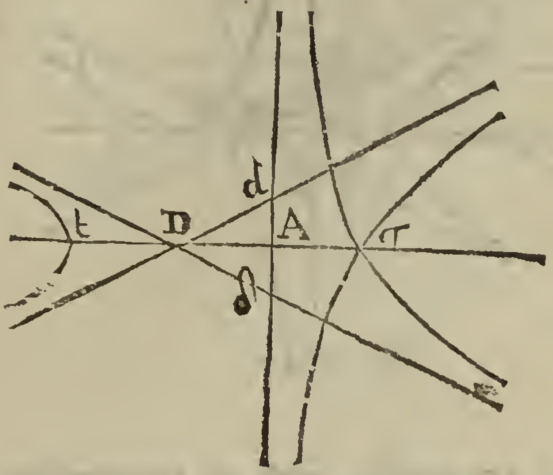
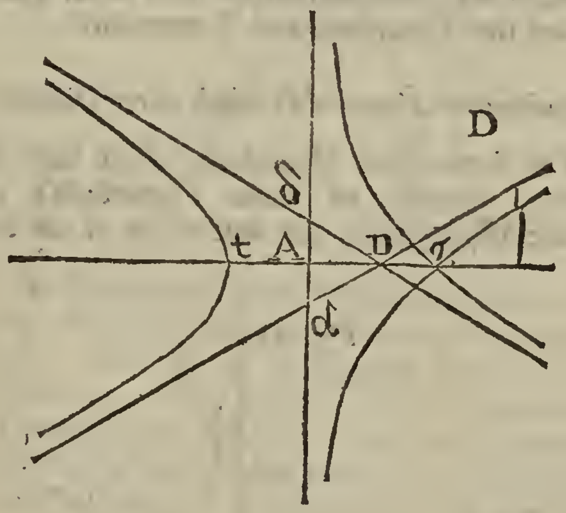


Fig. 25.



If two Roots are unequal, and of the ſame Sign, and the third be of a different one, there will be two Hyperbola's in the oppoſite Angles of

Fig. 26.

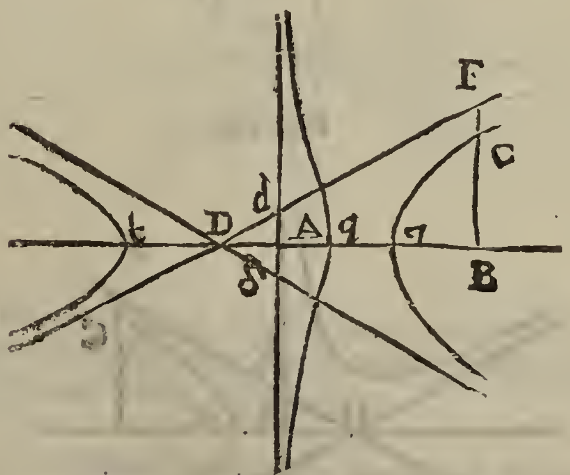
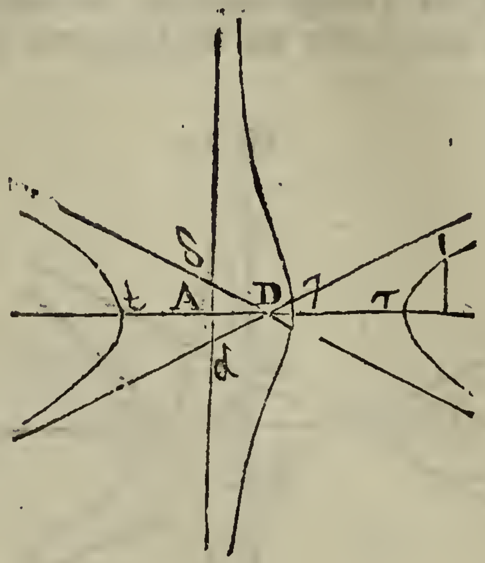


Fig. 27.



the two Aſſymptotes, with an intermediatte conchoidal one. And this conchoidal Hyperbola will either lie on the ſame Side of its Aſſymptote that the Aſſymptotick Triangle doth, or contrarily: And theſe two Caſes conſtitute two other Species, which are the Twentieth and Twenty-firſt.

Two Redundant Hyperbola's with three Diameters.

17. The Redundant Hyperbola which hath three Diameters, conſiſts of three Hyperbola's lying within the Aſſymptotes, and that either at the Sides, or at the Angle of the Aſſymptotick Triangle. The former Caſe makes the Twenty-ſecond, this latter the Twenty-third Species.

Fig. 28.

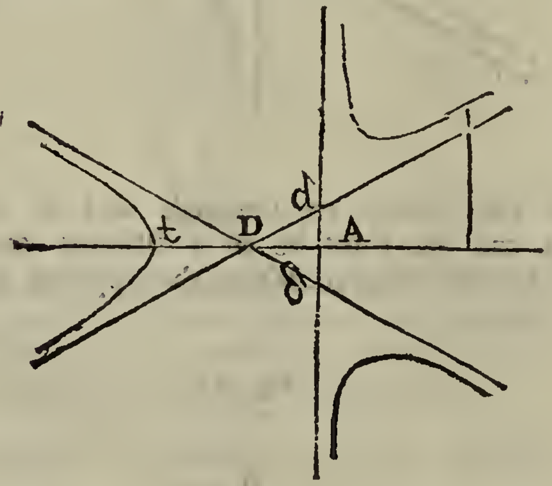
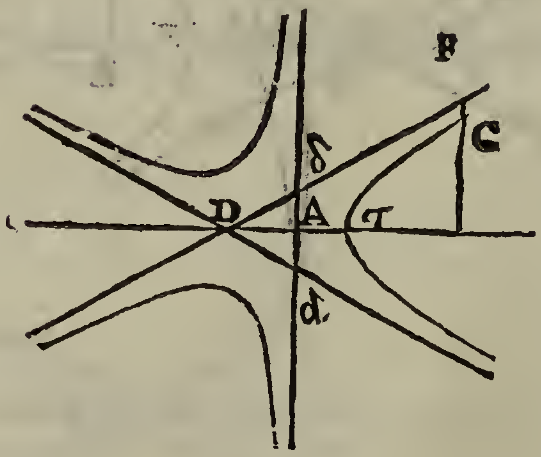


Fig. 29.



Nine Redundant Hyperbola's with three Aſſymptotes, converging towards one common Point.

18. If the three Aſſymptotes do interſect one another in one common Point, the 5th and 6th Species will be changed into a Twenty-fourth, the Seventh

Fig. 30.

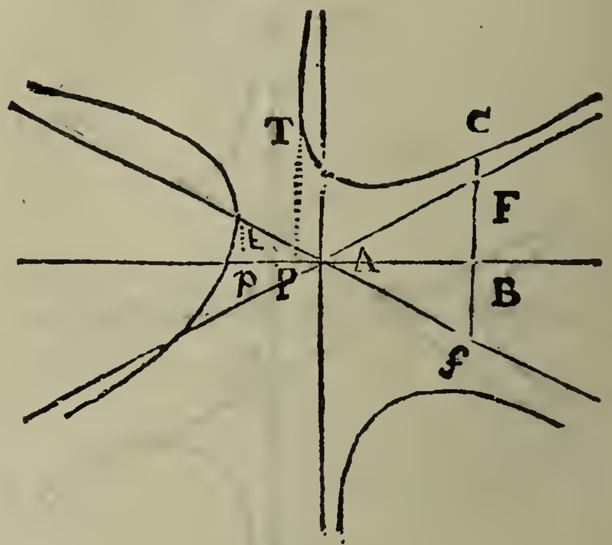


Fig. 31.

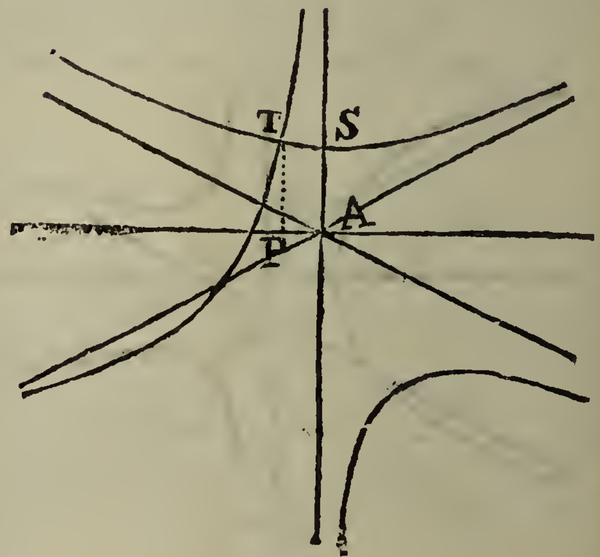
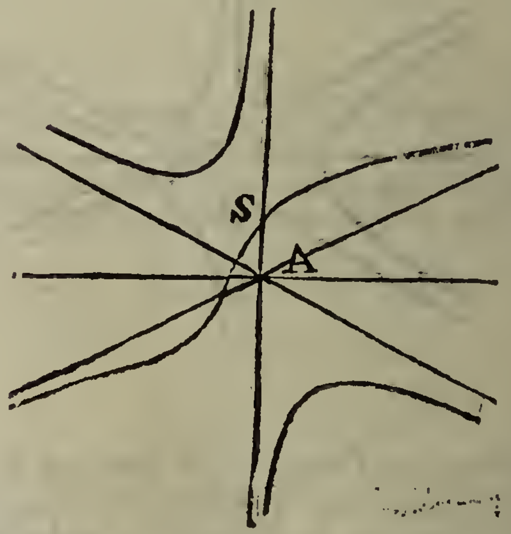
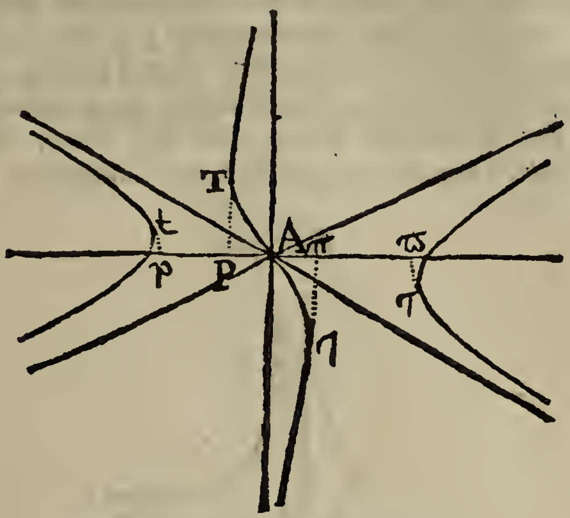


Fig. 32.



and

Fig. 33.



and Eighth into a Twenty-fifth, and the Ninth into a Twenty-ſixth Species, where the Anguineal doth not paſs thro' the Concourſe of the Aſſymptote, and into a Twenty-ſeventh, where it doth ſo; in which Caſe the Terms *b* and *d* are wanting, and the Concourſe of the Aſſymptotes is the Centre of the Figure, equally diſtant from all its oppoſite Parts. And theſe four Species have no Diameter.

The Fourteenth and Sixteenth Species may be changed alſo into a Twenty-eighth Species, and the Fifteenth and Seventeenth into a Twenty-ninth.

Fig. 34.

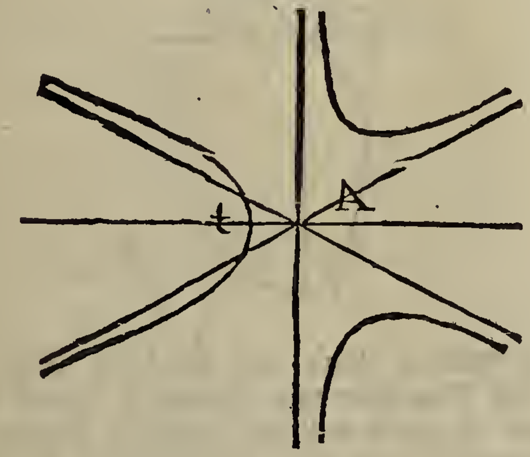


Fig. 35.

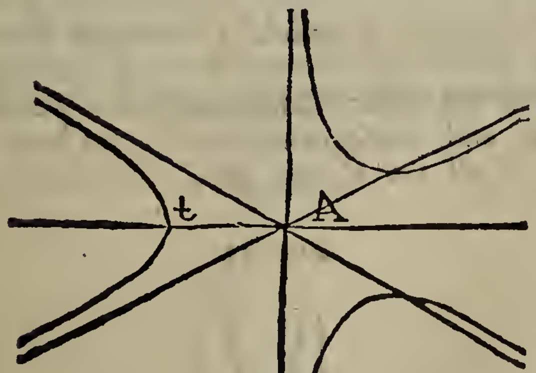


Fig. 36.

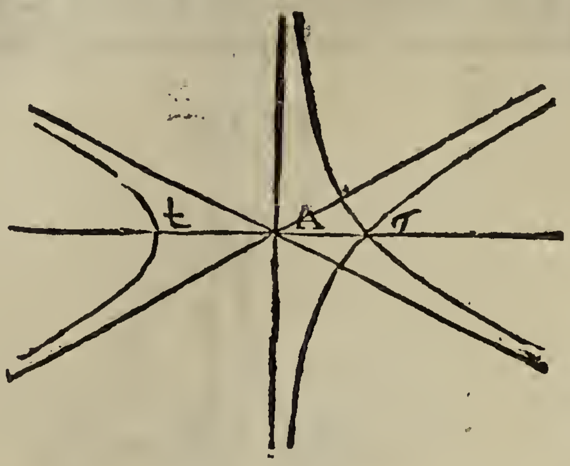
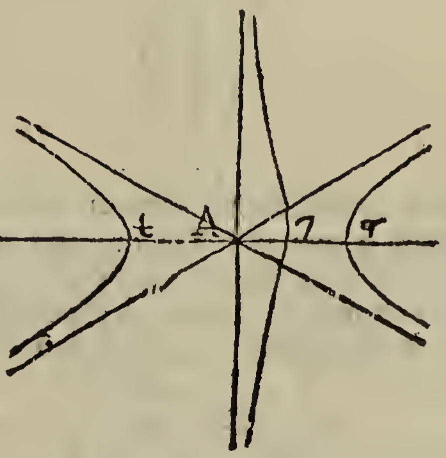
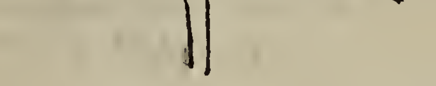


Fig. 37.



The Eighteenth and Nineteenth into a Thirtieth; and the Twentieth and Twenty-firſt into a Thirty-firſt. And all theſe Species have but one only Diameter. And finally, the Twenty-ſecond and Twenty-third Species, may be changed into a Thirty-ſecond, which hath three Diameters paſſing thro' the Point of Concourſe of the Aſſymptotes.

Fig. 38.



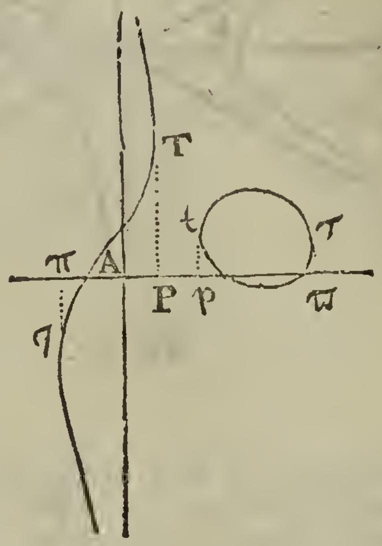
All which Changes will be eaſily underſtood, if you ſuppoſe the Aſſymptotick Triangle to be diminiſhed till it vaniſh into a Point.

Six deficient Hyperbola's, having no Diameter.

19. If in the firſt Caſe of the Equations, the Term $a\,x^3$ be negative, the Figure will be a deficient Hyperbola, having one only Aſſymptote, and only two Hyperbolick Legs running out infinitely towards the Side of the Aſſymptote, but quite contrary ways; and this Aſſymptote is the firſt and principal Ordinate, AG. If the Term $e\,y$ be not wanting, the Figure will have no Diameter; but if it be wanting, it will have but one: In the former Caſe the Species are thus enumerated:

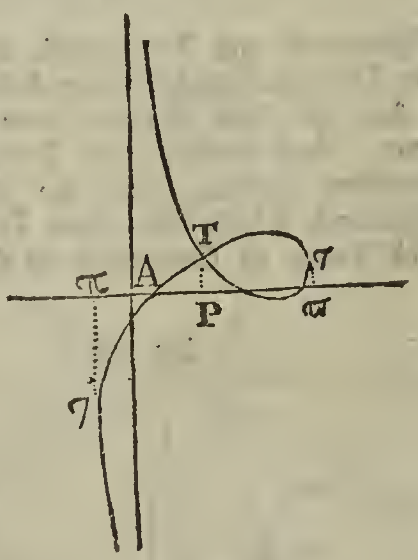
If all the Roots, A π, A P, A p, A ϖ, of this Equation, $ax^4 = bx^3 + cxx + dx + \frac{1}{4}ee$, be real and unequal, the Figure will be an Anguineal Hyperbola approaching towards the common Aſſymptote by a contrary Flexion, and with a conjugate Oval. Which makes the Thirty-third Species.

Fig. 39.



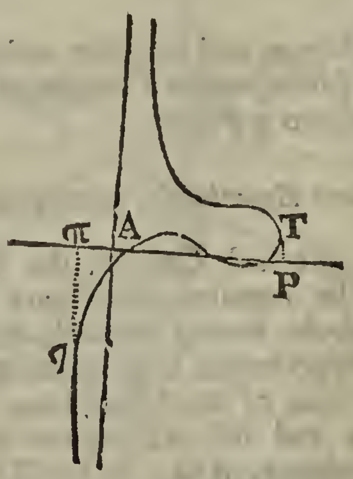
If the two middle Roots, A P and A p, be equal one to another, then the Oval and the Anguineal will be joined, decuſſating one another in the Form of a Node. And this is the Thirty-fourth Species.

Fig. 40.



If three of the Roots are equal, the Node will be changed into a moſt acute Cuſpis in the Vertex of the Anguineal. And this conſtitutes a Thirty-

Fig. 41.



of

If of the three Roots, having the ſame Sign, the two greateſt, A p and A π, are equal to one another then the Oval vaniſhes into a Point. Which makes a Thirty-ſixth Species. See *Fig.* 43.

If any two Roots are imaginary, there will remain the Anguineal alone, and this Pure, without any Oval, Decuſſation, Cuſpis, or Conjugate Point.

Fig. 42.

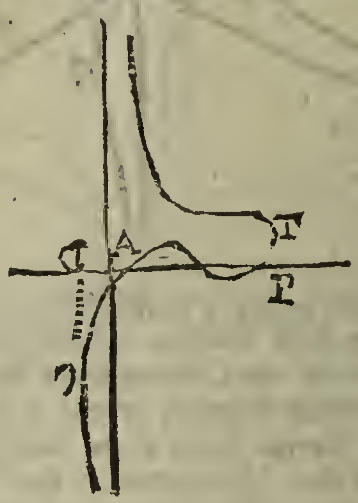
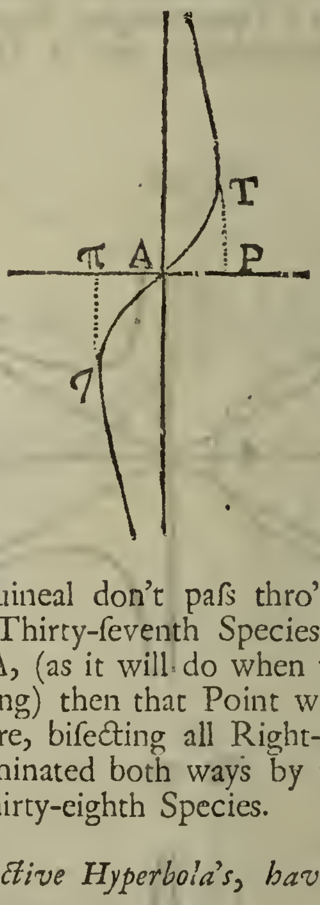


Fig. 43.

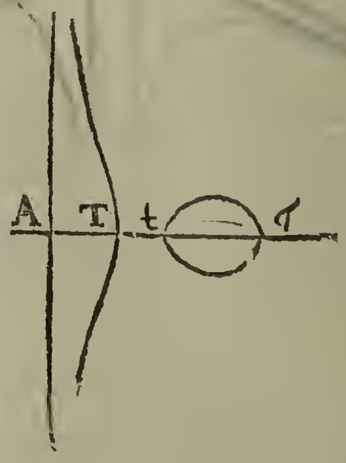


If the Anguineal don't paſs thro' the Point A, it makes the Thirty-ſeventh Species ; but if it doth paſs thro' A, (as it will do when the Terms b and d are wanting) then that Point will be the Centre of the Figure, biſecting all Right-lines drawn thro' it, and terminated both ways by the Curve. And this is a Thirty-eighth Species.

Seven defective Hyperbola's, having a Diameter.

20. In the other Caſe, where the Term ey is wanting, and conſequently the Figure hath a Diameter, if all the Roots, A T, A t, A τ, of the

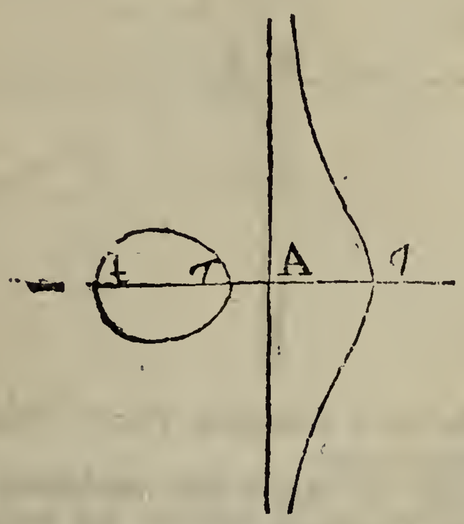
Fig. 45.



Equation $a x^3 + b x x + c x + d$, are real, unequal, and of the ſame Sign; then the Figure will be a Conchoidal Hyperbola, with an Oval on its convex Side. And this is a Thirty-ninth Species.

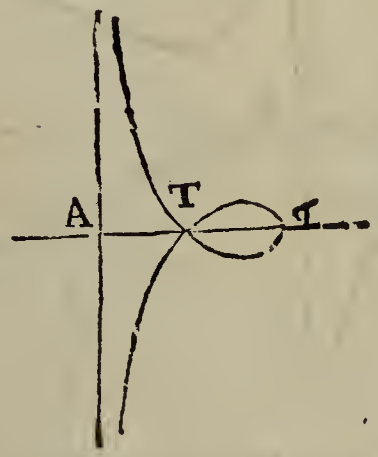
If two of the Roots are equal, and of the ſame Sign, but the third with a contrary Sign, the Oval will lie on the Concave Side of the Conchoidal Hyperbola. And this makes a Fortieth Species.

Fig. 44.



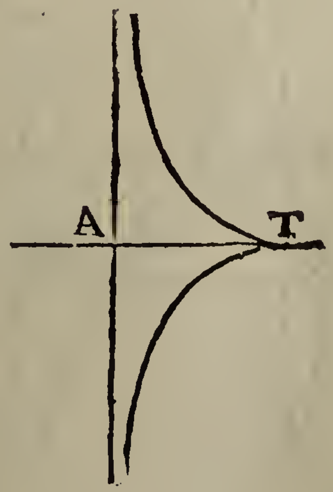
If the two leſſer Roots AT, At, are equal, and the third Aτ be of the ſame Sign with them, then the Oval and the Conchoidal will be joined, decuſſating one another like a Node. Which is a Forty-firſt Species.

Fig. 46.



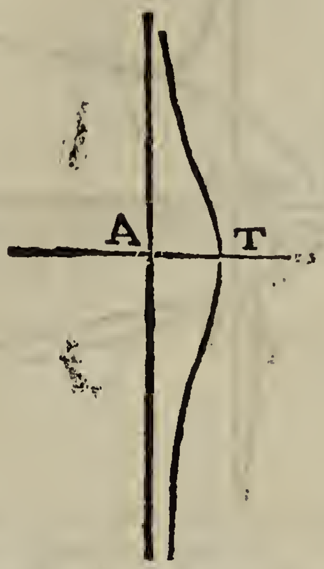
If the three Roots are equal, the Nodus will be changed into a Cuſpis, and the Figure will be the Ciſſoid of the Antients. And this makes a Forty-ſecond Species.

Fig. 47.



If the two greater Roots are equal, and the third of the ſame Sign with them, then the Conchoidal Hyperbola, will have a Conjugate Point at its Convexity. Which is a Forty-third Species.

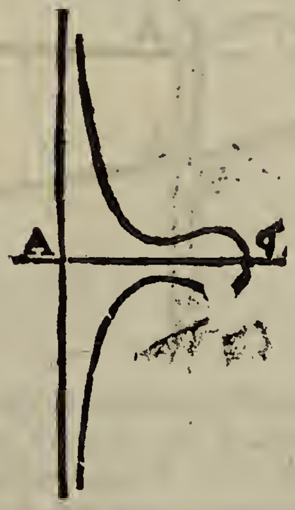
Fig. 49.



If two of the Roots are equal, and the Third have a contrary Sign, the Conchoidal Hyperbola will then have a Conjugate Point at its Concavity. Which makes a Forty-fourth Species.

If two of the Roots are impoſſible, there will be a pure Conchoidal without either Oval, Node, Cuſp, or Conjugate Point. And this is a Forty-fifth Species. (See *Fig.* 49.)

Fig. 48.

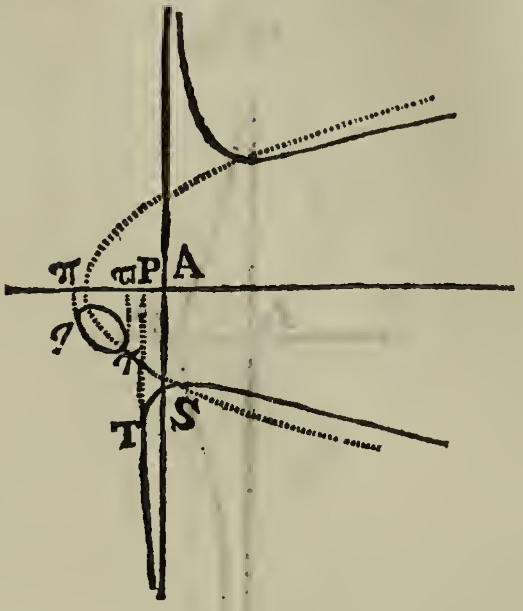


Seven Parabolick Hyperbola's, having no Diameter.

21. If in the firſt Caſe of the Equations, the Term $a x^3$ be wanting, but the $b b x$ be not wanting; then the Figure will be a Parabolick Hyperbola, having two Hyperbolick Legs to one Aſſymptote SAG, converging towards one and the ſame Sign. If the Term $e y$ be not wanting, the Figure will have no Diameter; but if it be wanting, it will have one only: In the former Caſe the Species will be theſe.

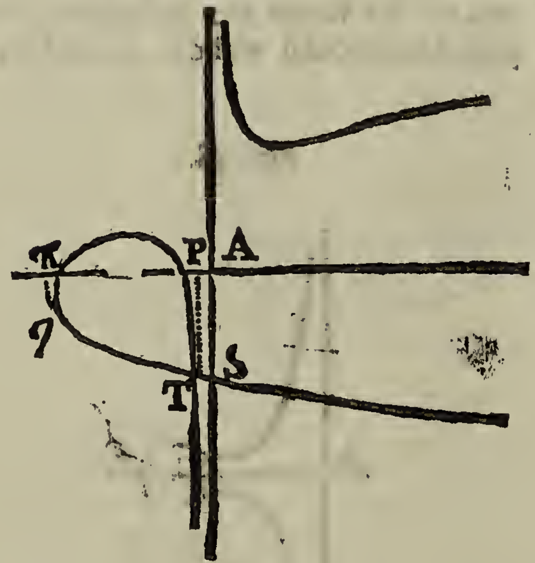
If the three Roots AP, Aϖ, Aπ, of this Equation $b x^3 + c x^2 + d x + \frac{e e}{4} = o$, be unequal, and have the ſame Sign, the Figure will conſiſt of an Oval, and of two other Curves, which are partly Hyperbolical, and partly Parabolical; that is, the Parabolick Legs, by being continually drawn out, are joined with the Hyperbolical Legs which are next to them. And this is the Forty-ſixth Species.

Fig. 50.



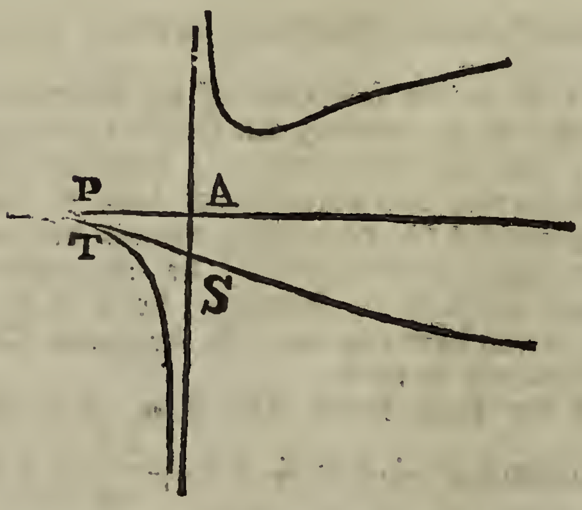
If the two leſſer Roots are equal, and the third of the ſame Sign with them; then will the Oval, and one of thoſe Hyperbola Parabolick Curves be joined, and interſect one another in the Form of a Node. Which is the Forty-ſeventh Species.

Fig. 51.



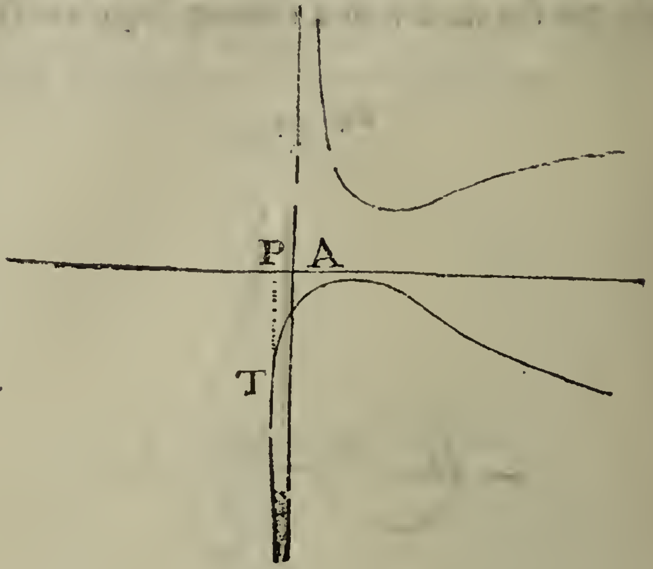
If the three Roots are equal, the Node will turn into a Cuſp. Which makes a Forty-eight Species.

Fig. 52.



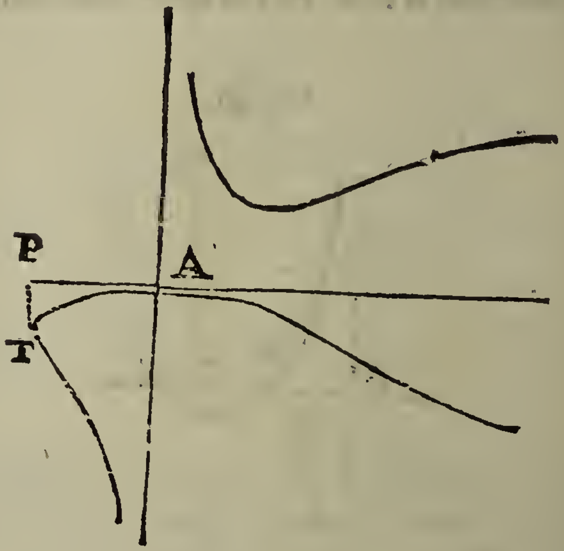
If the two greateſt Roots are equal, and the third hath the ſame Sign with them, the Oval will vaniſh into a Conjugate Point. Which is the Forty-ninth Species.

Fig. 59.



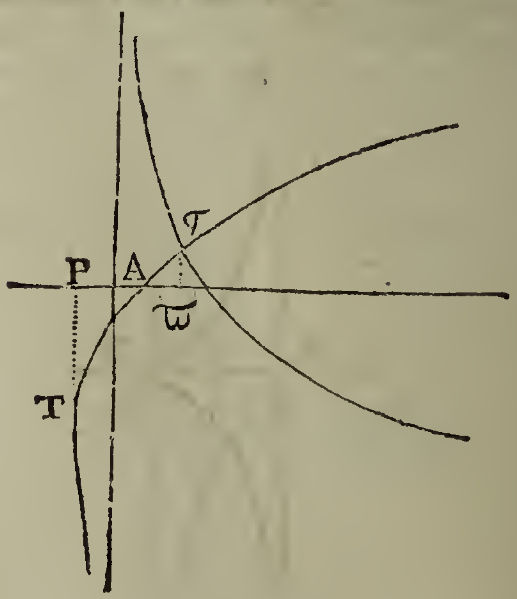
If two of the Roots are impoſſible, the two Hyperbola Parabolick Curves will remain pure; (See *Fig.* 53.) without any Oval, Decuſſation, Cuſp, or Conjugate Point. And this will make a Fiftieth Species.

Fig. 54.



If two of the Roots be equal, and the third have a contrary Sign to them, then the Hyperbola

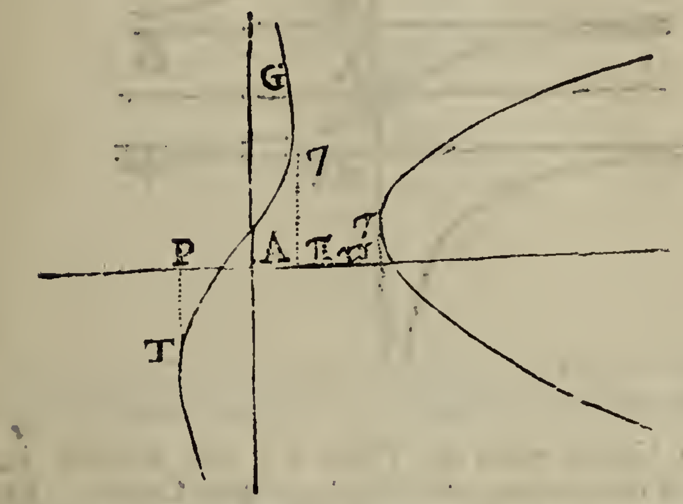
Fig. 55.



Parabolick Curves will be joined, decuſſating one another in the Form of a Croſs. And this is the Fifty-firſt Species.

If the two Roots are unequal, and of the ſame Sign, and the third have a contrary Sign, the Figure will become an Anguineal Hyperbola about the Aſſymptote A G, together with a Conjugate Parabola. And this will be a Fifty-ſecond Species.

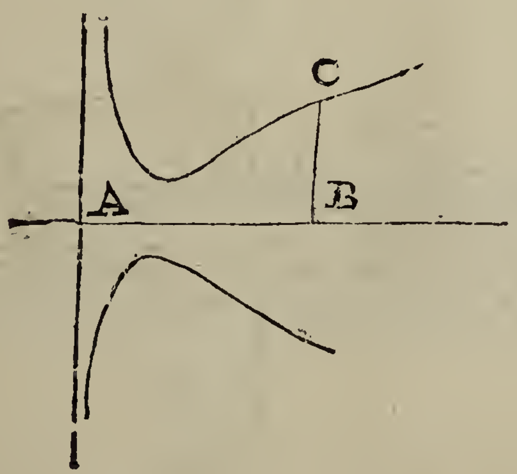
Fig. 56.



Four Parabolick Hyperbola's which have a Diameter.

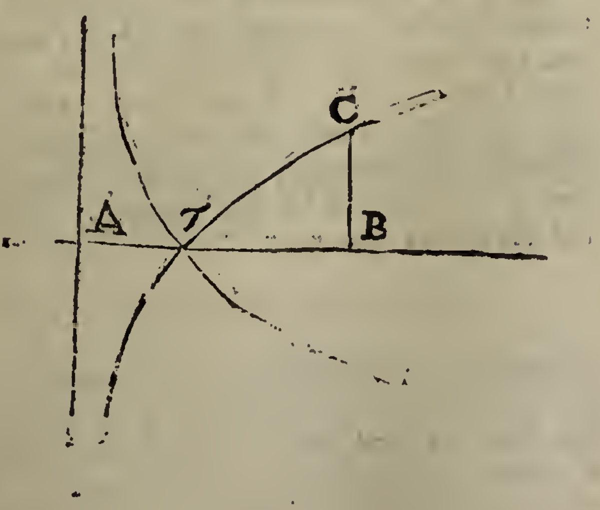
22. In the other Caſe, where the Term $e y$ is wanting, and the Figure hath a Diameter, if the two Roots of this Equation $b x x + c x + d = 0$, are impoſſible, there will be two Hyperbola Parabolick Figures equally diſtant from the Diameter AB, and one on one Side, and the other on the other, which will conſtitute a Fifty-third Species.

Fig. 57.



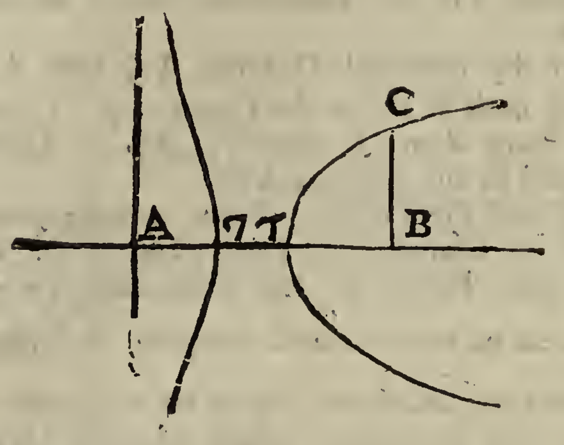
If the two Roots of this Equation be impoſſible, the Hyperbola Parabolick Figures will join, and interſect one another in the Form of a Croſs. And this will be a Fifty-fourth Species.

Fig. 58.



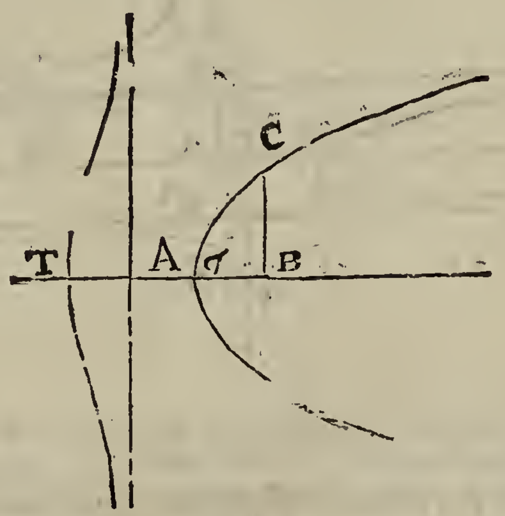
If the Roots are equal, and have the ſame Sign, there will be a Conchoidal Hyperbola with a Parabola on the ſame Side of the Aſſymptote. And this makes a Fifty-fifth Species.

Fig. 59.



If the Roots have contrary Signs, there will be a Conchoidal Hyperbola on one Side of the Aſſymptote, and a Parabola on the other. And this makes a Fifty-ſixth Species.

Fig. 60.



Four Hyperboliſms of the Hyperbola.

23. Whenever in the firſt Caſe of the Equations the Term $a x^3$ and $b x x$ are both wanting, the Figure will be a Hyperboliſm of ſome Conick Section.

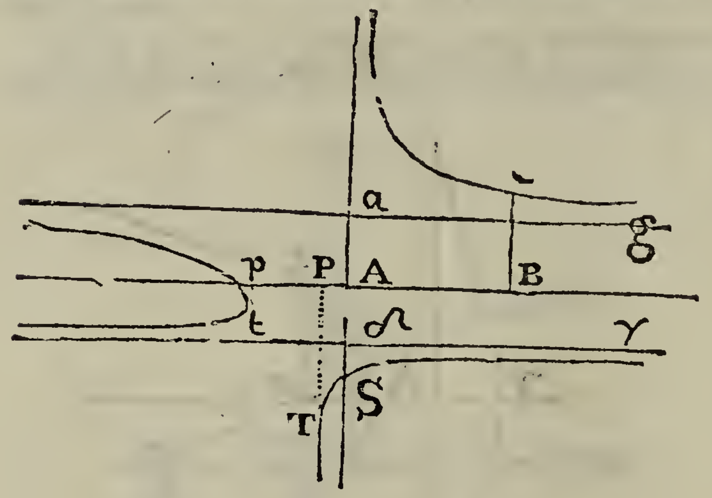
I call that the Hyperboliſm of a Figure, when the Ordinate comes out by dividing the Rectangle under the Ordinate of that Figure and a given Right-line, by the common Abſciſſa. By this Means a Right-line is changed into a Conick Section, and every Conick Section into ſome one of thoſe Figures which I here call the Hyperboliſms of the Conick Sections. For the Equation for the Figure, of which we now ſpeak, *viz.* $x y y + e y = c x + d$, gives the Ordinate $y = \frac{e \pm \sqrt{ee + 4dx + 4cxx}}{2x}$; which is generated by dividing the Rectangle under the Ordinate of the Conick Section, $\frac{e \pm \sqrt{ee + dx + 4cxx}}{2m}$ and a given Right-line m, by the common Abſciſſa x. Whence it is plain, that the Figure produced will be the Hyperboliſm of an Hyperbola, Ellipſis, or Parabola, according as the Term $c x$ is Affirmative or Negative, or quite wanting.

The Hyperboliſm of an Hyperbola hath three Aſſymptotes, of which one is the firſt and principal Ordinate Ad, the other two are Parallels to the Abſciſſa A B, and equidiſtant from it on each Side of it.

In the principal Ordinate Ad, take Ad, Aδ, equal both Ways to the Quantity $\sqrt{:c}$; and thro' the Point d and δ, draw dg, $\delta\gamma$ as Aſſymptotes, parallel to the Abſciſſa A B.

When the Term $e y$ is not wanting, the Figure hath no Diameter. In this Caſe, if A P and A p, the two Roots of the Equation $c x x + d x + \frac{e e}{4} = 0$, are real and unequal, (for equal they cannot be, unleſs the Figure be a Conick Section) then will the Figure conſiſt of three Hyperbola's oppoſite to one another; of which, one lies between the parallel Aſſymptotes, and the other two without them. And this is a Fifty-ſeventh Species.

Fig. 61.



If the two Roots are impoſſible, there will be two oppoſite Hyperbola's without the parallel Aſſymptotes, and an Hyperbolical Anguineal within them. This Figure is of two Species; for it hath no Centre when the Term d is not wanting, but if d be wanting, the Point A is its Centre. The former of theſe makes a Fifty-eighth, the latter a Fifty-ninth Species.

Fig. 62.

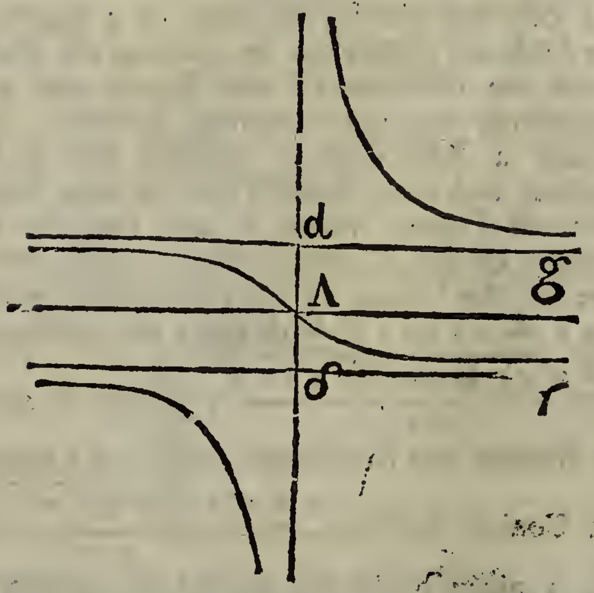
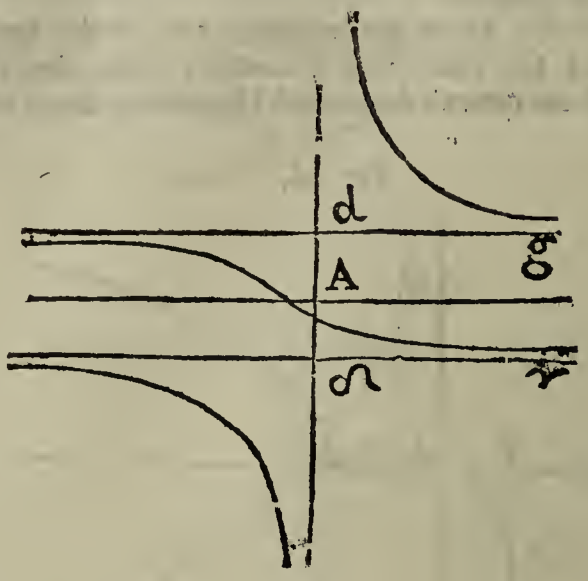
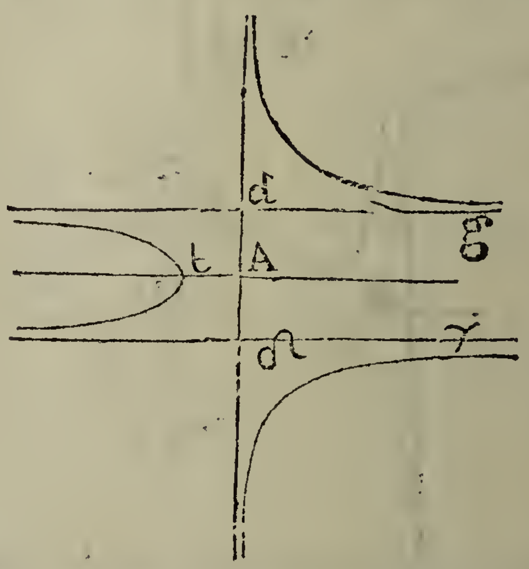


Fig. 63.



But if the Term $e y$ is wanting, the Figure will conſiſt of three oppoſite Hyperbola's, of which one will lie between the parallel Aſſymptotes, and the other two without, as in the Fifty-fourth Species: And beſides this, it will have a Diameter, which is the Abſciſſa A B. And this conſtitutes a Sixtieth Species.

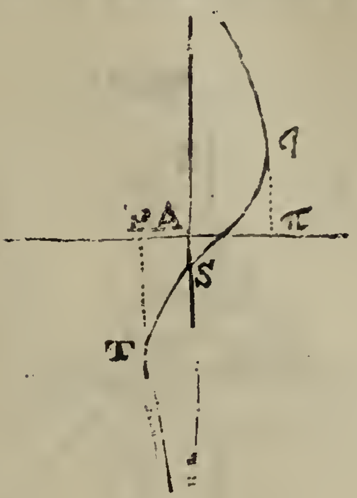
Fig. 64.



Three Hyperboliſms of the Ellipſe.

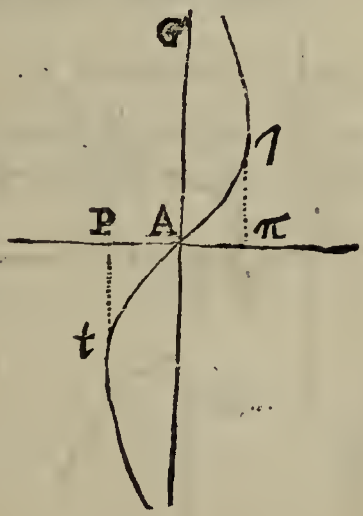
24. The Hyperboliſm of an Ellipſis is determined by this Equation $x y y + e y = c x + d$; and hath only one Aſſymptote, which is the principal Ordinate Ad. If the Term $e y$ be not wanting, the Figure will be an Anguineal Hyperbola without any Diameter, and even without any Centre, if the Term d be not wanting. Which makes the Sixty-firſt Species.

Fig. 65.



But if the Term *d* be wanting, the Figure wil have a Centre without any Diameter, which wil

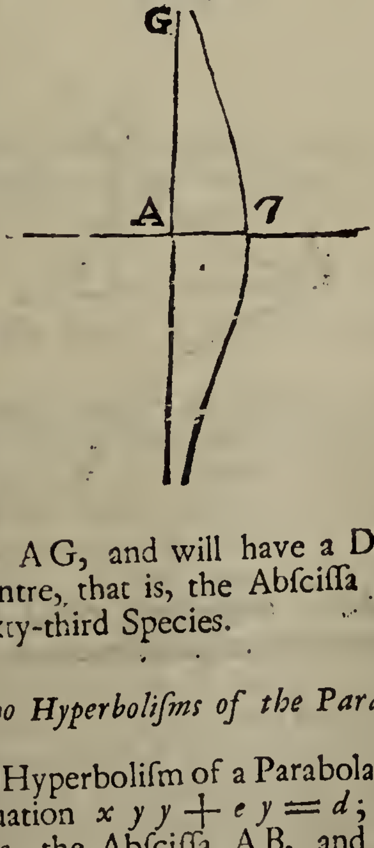
Fig. 66.



be the Point A. And this makes a Sixty-ſecond Species.

And if the Term *e y* be wanting, and not *d*, the Figure will be a Conchoidal Hyberbola to the

Fig. 67.



Aſſymptote A G, and will have a Diameter without any Centre, that is, the Abſciſſa A B. Which makes a Sixty-third Species.

Two Hyperboliſms of the Parabola.

25. The Hyperboliſm of a Parabola is determined by this Equation $x\,y\,y + e\,y = d$; and hath two Aſſymptotes, the Abſciſſa A B, and the firſt and principal Ordinate A G. But the Hyperbola's in this Figure are two, not lying in the oppoſite Angles of the Aſſymptote, but in the contiguous or adjoining ones, and that on each Side the Abſciſſa

Fig. 68.

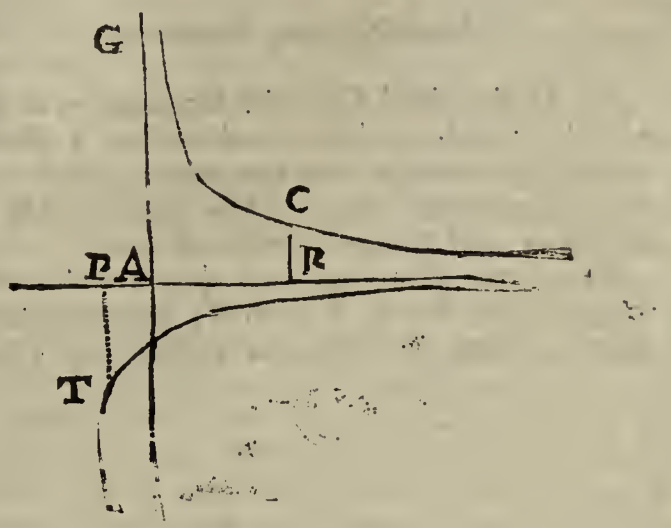
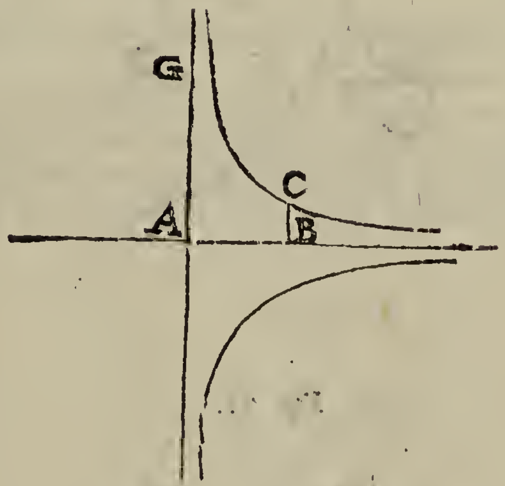


Fig. 69.

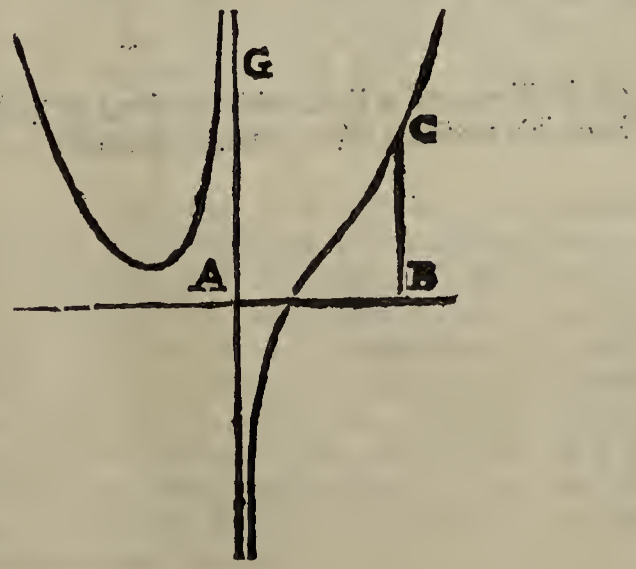


A B; and even without any Diameter, if the Term *e y* be there, but with one if that be wanting. Which two Species are the Sixty-fourth and Sixty-fifth.

A Trident.

26. In the ſecond Caſe of the Equation there is $x\,y = a\,x^3 + b\,x\,x + c\,x + d$: And the Figure in this Caſe will have four infinite Legs, of which

Fig. 76.



two are Hyperbola's about the Aſſymptote A G tending towards contrary Parts, and two converging Parabola's, and, with the former, making as it were the Figure of a Trident. And this Figure is that Parabola by which *Des Cartes* conſtructed Equations of ſix Dimenſions. This therefore is the Sixty-ſixth Species.

Five Diverging Parabola's.

27. In the third Caſe the Equation was $yy = ax^3 + bxx + cx + d$; and deſigns a Parabola, whoſe Legs diverge from one another, and run out infinitely contrary ways. The Abſciſſa AB is its Diameter, and its five Species are theſe:

If, of the Equation $ax^3 + bxx + cx + d = 0$, all the Roots $A\tau$, AT, At, are real and unequal; then the Figure is a diverging Parobola of the Form of a Bell, with an Oval as its Vertex. And this makes a Sixty-ſeventh Species.

Fig. 70.

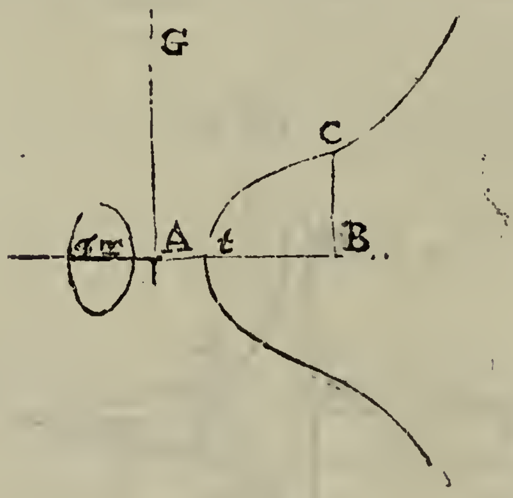
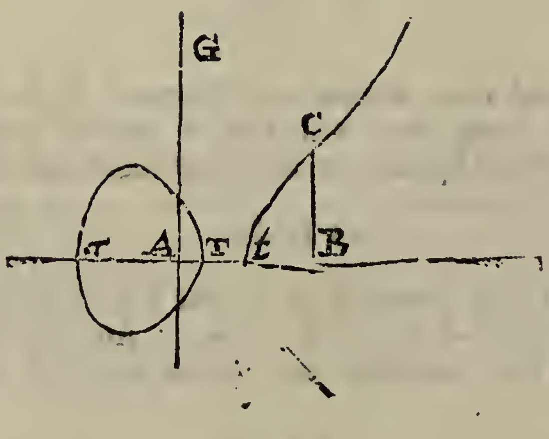


Fig. 71.



If two of the Roots are equal, a Parabola will be formed, either Nodated by touching an Oval, or Punctate, by having the Oval infinitely ſmall. Which two Species are the Sixty-eighth and Sixty-ninth.

Fig. 72.

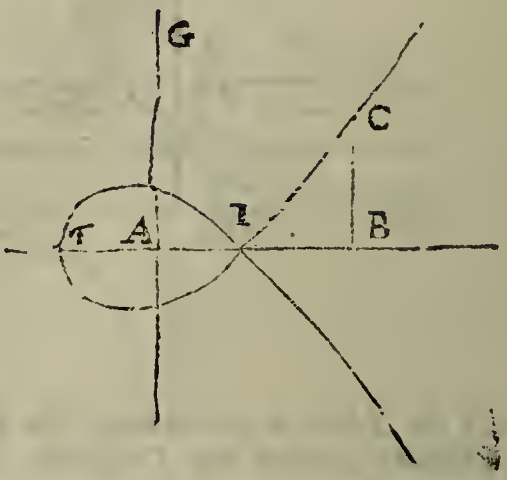
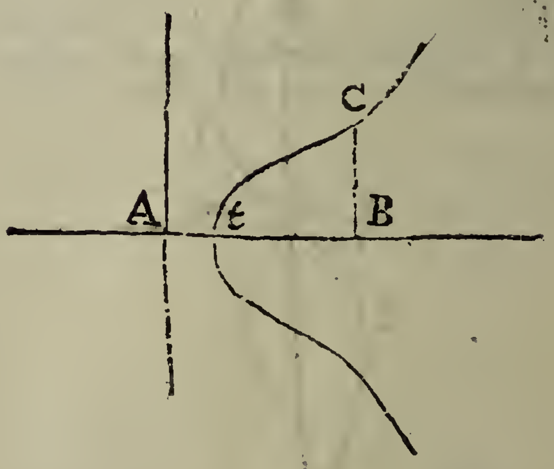
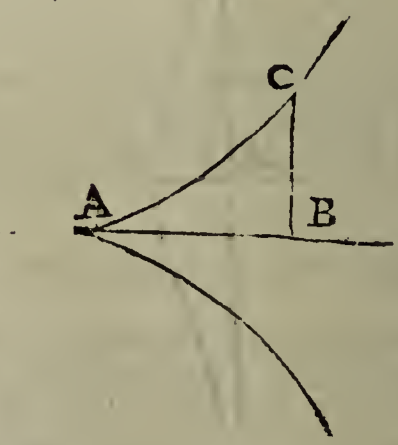


Fig. 73.



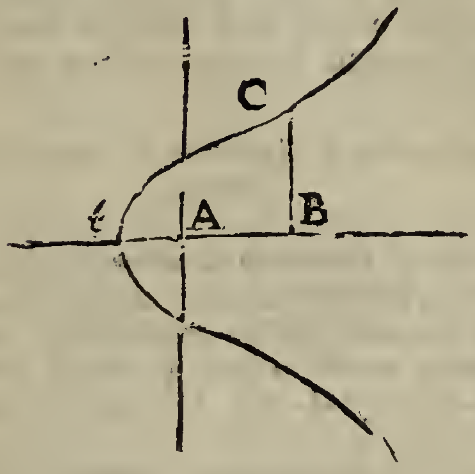
If three of the Roots are equal, the Parabola will be Cuſpidate at the Vertex. And this is the *Neilian* Parabola, commonly called *Semi-cubical.* Which makes the Seventieth Species.

Fig. 75.



If two of the Roots are impoſſible, there will (See *Fig.* 73.)

Fig. 73.

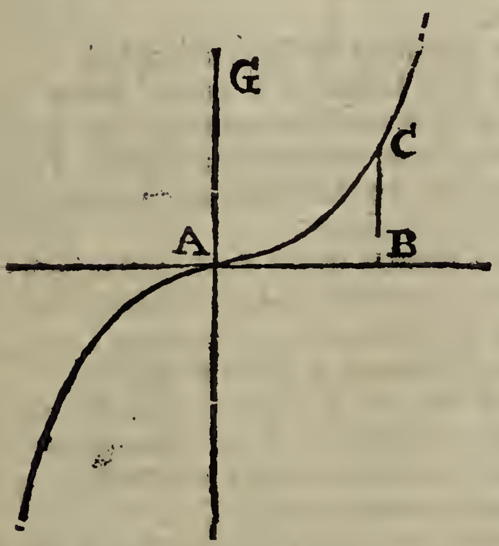


be a pure Parabola of a Bell-like Form. And this makes the Seventy-firſt Species.

The Cubical Parabola.

28. In the fourth Caſe, let the Equation be $y = ax + bxx + cx + d$; then will it denote

Fig. 77.



the Cubical Parabola with contrary turned Legs. And this makes up, or compleats the Number of the Species of theſe Curves, to be in all Seventy-two.

Of the Geneſis of Curves by Shadows.

29. If the Shadows of Figures are projected on an infinite Plane illuminated from a lucid Point, the Shadows of the Conick Sections will always be Conick Sections; thoſe of the Curves of the Second Gender, will always be Curves of the Second Gender; and the Shadows of Curves of the Third Gender, will themſelves be of the ſame Gender, and ſo on *in infinitum*. And as a Circle, by the Projection of its Shade, generates all the Conick Sections; ſo will the five diverging Parabola's ſpoken of in *ch.* 28. by their Shadows generate and exhibit all Curves of the Second Gender; and ſo ſome more ſimple Curves of other Genders may be found, which, by the Projection of their Shadows from a lucid Point upon a Plane, ſhall form all other Curves of the ſame Kinds.

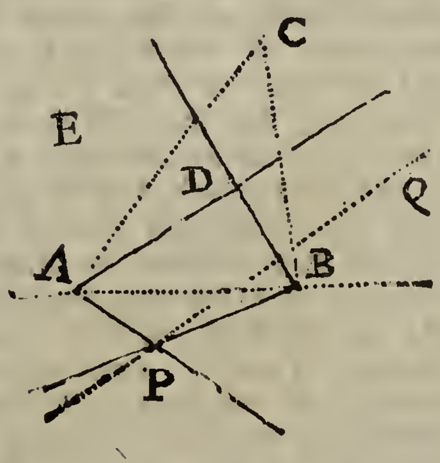
Of the double Points of Curves.

30. I ſaid above, that Curves of the Second Gender might be cut by a Right-line in three Points; but two of thoſe Points are ſometimes co-incident. As when the Right-line paſſes by an Oval infinitely ſmall, or by the Concourſe of two Parts of a Curve mutually interſecting each other, or running together into a Cuſpis. And if at any time all the Right-lines, tending the ſame Way with the infinite Leg of any Curve, do cut it in one only Point, (as happens in the Ordinate of the *Carteſian*, and in the Cubical Parabola, and in the Right-lines which are parallel to the Abſciſſa of the Hyperboliſms of Hyperbola's and Parabola's) then you are to conceive that thoſe Right-lines paſs through two other Points of the Curve (as I may ſay) placed at an infinite Diſtance; and theſe two co-incident Interſections, whether they be at a finite or an infinite Diſtance, I call the *double Point*. And ſuch Curves as have this double Point, may be deſcribed by the following Theorems.

Theorems for the Organical Deſcription of Curves.

31. *Theorem* I. If two Angles, as P A D and P B D, whoſe Magnitude is given, be turned round the Poles A and B, given alſo in Poſition; and their Legs A P, B P, by their Point of Concourſe P, deſcribe a Conick Section paſſing through their Poles A and B; except when that Right-line happens to paſs through either of the Poles A or B, or when the Angles B A D and A B D vaniſh together into nothing; for in ſuch Caſes the Point will deſcribe a Right-line.

Fig 78.



II. If the firſt Legs A P, B P, by their Point of Concourſe P, do deſcribe a Conick Section paſſing through the Pole A; then will the two other Legs A D, B D, by their Point of Concourſe D, deſcribe a Curve of the Second Gender, paſſing through the other Pole B, and having a double Point in the firſt Pole A, through which the Conick Sections, except when the Angles B A D, A B D, vaniſh both away together; for then the Point D will deſcribe another Conick Section paſſing through the Pole A.

III. But if the Conick Section which the Point P deſcribes, paſs through neither the Pole A nor B; then the Point D will deſcribe a Curve of the ſecond or third Gender, having a double Point;

and that double Point will be in the Concourſe of the deſcribent Legs A D and B D, when the Angles B A P, A B P, vaniſh together: And the Curve deſcribed, will be one of the Second Gender, if the Angles B A D, A B D vaniſh together; otherwiſe 'twill be one of the Third Kind, and then it will have two other double Points in the Poles A and B.

The Deſcription of the Conick Section by five given Points.

32. A Conick Section is determined by having five of its Points given; and may be thus deſcribed by them: Let the five Points be A, B, C, D, and E; join any three of them together, as ſuppoſe A, B and C, and form the Triangle A B C, and ſuppoſe any two of its Angles, as C A B and C B A, to revolve round their Vertices A and B; and when C, the Interſection of the Legs A C, B C, is ſucceſſively applied to the other two Points D, E, let the Interſection of the other Legs A B, and B A, fall in the Point P and Q. Let alſo the Line P Q be drawn, and infinitely produced; and let the moveable Angles be ſo turned round, that the Interſection of the Legs A P and B P, may deſcribe the Right-line P Q: And then will the Interſection of the two other Legs C, deſcribe the propoſed Conick Section, by *Theor.* I.

The Deſcription of Curves of the Second Gender having a double Point, by ſeven given Points.

33. All Curves of the Second Gender which have a double Point, are determined from their ſeven given Points, of which one is that double Point. And by means of thoſe Points they may be thus deſcribed: Let there be given any ſeven Points of the Curve to be deſcribed, as A, B, C, D, E, F, and G; of which A is the double Point. Join A with any other two Points, as ſuppoſe B and C; and then let both the Angles C A B, and alſo either of the other two Angles of the Triangle A B C (as the Angle A B C) revolve round the two Vertexes A and B. And when the Point of Concourſe C, of the Legs A C, B C, is ſucceſſively applied to the four remaining Points D, E, F, and G; let the Concourſe of the two other Legs, A B and B A, fall in the four Points P, Q, R, S. Through theſe four Points, and the fifth Point A, deſcribe a Conick Section; and let the aforeſaid Angles C A B and C B A ſo revolve, that the Point of Concourſe of the Legs A P, P B, may deſcribe that Conick Section: Then ſhall the Point of Concourſe of the other Legs A C, B C, deſcribe the Curve propoſed, by *Theorem* the Second.

If inſtead of the Point C, the Right-line B C be given in Poſition, and which ſhall touch the Curve to be deſcribed in B; then the Lines A D, A P, will be coincident; and inſtead of the Angle D A P, there will be a Right-line revolving round the Pole A.

If the double Point A be infinitely diſtant, the Right-line will perpetually tend with a Direction towards that Point, and will be carried with a parallel Motion, while the Angle A B C revolves about the Pole B.

Theſe Curves may alſo be deſcribed after another Manner, by the Third *Theorem*; but 'tis enough to ſhew you the moſt ſimple Way of their Deſcription.

After the ſame Method may Curves of the Third, Fourth, and yet higher Genders, be deſcribed; not all indeed, but ſuch as by ſome commodious Ratio may be deſcribed by local Motion: For how commodiouſly to deſcribe ſome Curves of the ſecond or higher Genders, when they have no common Point, is a Problem that muſt be reckoned amongſt the more difficult ones.

The Conſtruction of Equations by the Deſcription of Curves.

The Uſe of Curves in Geometry is, that by their Interſections Problems may be ſolved. Let an Equation be propoſed to be conſtructed, having nine Dimenſions, as $x^9 * + b x^7 + c x^6 + d x^5 + e x^4 \begin{array}{l} + f \\ + m \end{array} x^3 + g x x + h x + k = 0$; where b, c, d, *&c.* ſignify any given or known Co-efficients, adfected with the Signs + and —. Let an Equation to a Cubical Parabola $x^3 = y$ be aſſumed: Then will the former Equation, putting y for x^3, ſtand thus, $y^3 + b x y y + c y y + d x x y + e x y + m y + f x^3 + g x x + h x + k = 0$, be an Equation to another Curve of the Second Gender, where m or f may either be wanting or aſſumed at Pleaſure. And by the Deſcriptions of theſe Curves and their Interſections, there will be found the Roots of the Equation at firſt given to be conſtructed.

Note, 'Tis enough to deſcribe the Cubical Parabola once.

If the Equation to be conſtructed, by reaſon of the two laſt Terms $h x$ and k being wanting, is depreſſed to ſeven Dimenſions; the other Curve, by expunging m, will have a double Point in the Beginning of the Abſciſſa, and therefore may eaſily be deſcribed as above.

If the Equation to be conſtructed hath the three laſt Terms $g x x + h x + k$ wanting, and therefore is but of ſix Dimenſions, the other Curve, expunging f, will become a Conick Section.

And if the ſix laſt Terms being wanting, the Curve be reduced to three Dimenſions, its Conſtruction will fall in with Dr. *Wallis*'s, by the Cubical Parabola and a Right-line.

Equations may alſo be conſtructed by the Hyperboliſm of a Parabola with a Diameter. Suppoſe this Equation of nine Dimenſions, and wanting its laſt Term, ſave one, were to be conſtructed, $a + c x x + d x^3 + e x^4 + f x^5 \begin{array}{l} + g \\ + m \end{array} x^6 + h x^7 + k x^2 + l x^9 = 0$. Let there be an Equation aſſumed to that Hyperboliſm; thus, $x x y = 1$; and ſubſtituting y for $\frac{1}{x x}$, the Equation to be conſtructed will be changed into this Form, $a y^3 + c y y + d x y y + e y + f x y + m x x y + g + h x + k x x + l x^2 = 0$, which denotes a Curve of the ſecond Gender, by whoſe Deſcription the Problem may be ſolved, and of the Quantities m and g, either may be wanting or aſſumed at Pleaſure.

By the Cubical Parabola and Curves of the third Genders, all Equations may be conſtructed, not exceeding twelve Dimenſions; and by the ſame Parabola, and a Curve of the fourth Gender, all Equations not exceeding fifteen Dimenſions, and ſo on infinitely. And theſe Curves of the third, fourth, and ſuperior Genders, may always be deſcribed by finding their Points by plain Geometry.

As if this Equation were to be conſtructed, $x^{12} * + a\,x^{10} + b\,x^{9} + c\,x^{8} + d\,x^{7} + e\,x^{6} + f\,x^{5} + g\,x^{4} + h\,x^{3} + i\,x\,x + k\,x + l = 0$, and the Cubical Parabola be ſuppoſed to be deſcribed; let the Equation for that Cubical Parabola be $x = y^3$: Wherefore ſubſtituting y for x^3, the Equation will put on this Form:

$$\begin{array}{llll} y^4 + a\,y\,y^3 & + c\,x\,x\,y & + f\,x\,x\,y & + i\,x\,x = 0. \\ \quad + b & + d\,x & + g\,x & + k\,x \\ & + e & + h & + l \end{array}$$

Which is an Equation to a Curve of the Third Gender, by whoſe Deſcription the Problem may be ſolved. And this Curve may be deſcribed by finding its Points by plain Geometry, becauſe the indeterminate Quantities relate not to above two Dimenſions.

In the Memoirs of the *French* Academy of Sciences for the Year 1699, there is a Method for finding the Curves, which Bodies riſing towards, or aſcending from the Horizon, will deſcribe, let the Ratio of the Time of the Deſcent or the Aſcent, and the Acceleration or Retardation be what it will. Communicated by Mr. *Varignon.*

CUSP [*Cuſpis, L.*] properly ſignifies the Point of a Spear.

CUSP [in *Aſtronomy*] a Term uſed to expreſs the Points or Horns of the Moon, or other Luminary.

CUSP [in *Aſtrology*] is uſed to ſignify the firſt Point of the twelve Houſes, in a Figure or Scheme of the Heavens.

CUSPIDATED, [in *Botany*] a Term uſed of Plants, when the Leaves of the Flower end in a Cuſp or Point reſembling that of a Spear. *L.*

CUSPIDATED *Hyperbola*, is a Kind of Hyperbola, whoſe two Parts concur and terminate in the Angle of Contact.

CUSTODE *admittendo*, and *Cuſtode amovendo*, are Writs for the admitting or removing of Guardians. *L.*

CUSTODES *Libertatis Angliæ authoritate Parliamenti*, was the Stile wherein Writs and other Judicial Proceedings did run during the late Times of Trouble; *viz.* from the Murder of King *Charles* I. till the Uſurpation by *Cromwell*, mentioned and declared traiterous by the *Stat.* 12. *Car.* II. *Cap.* 3.

CUSTOM is (both by common Lawyers and Civilians, taken to be) a Law or Right not committed to Writing, but eſtabliſhed by long Uſe, and by the Conſent of our Anceſtors, hath been, and is daily practiſed; and 'tis either General or Particular. A General Cuſtom, is, that which is allowed throughout all *England.* Particular Cuſtom, is, that which belongeth to this or that County, or to this or that Lordſhip, Town, or City.

CUSTOMARY *Tenants* [in *Law*] ſuch Tenants as hold by the Cuſtom of the Manor, as their ſpecial Evidence. Theſe were anciently Bond-men, or ſuch as held *Tenura Bondagis.*

CUSTOMS *and Services*, or *Conſuetudinibus & Servitiis*, is a Writ of Right cloſe, which lieth againſt the Tenant that deforceth his Lord of the Rent or Service due to him. Of this ſee more at large in the *Old Nat. Brev. Fol.* 77.

CUSTOS *Brevium*, a Clerk belonging to the Court of Common Pleas, whoſe Office is to receive and keep all the Writs, and put them upon Files, every Return by itſelf; and at the End of every Term, to receive of the Prothonotaries all the Records of the *Niſi prius*, called the *Poſtea.* *L.*

CUSTOS *Placitorum Coronæ*, ſeems to be the ſame with *Cuſtos Rotulorum.* *L.*

CUSTOS *Rotulorum*, is he that hath the Cuſtody of the Rolls or Records of the Seſſions of Peace; and, as ſome ſay, of the Commiſſions of Peace itſelf. He is always a Juſtice of Peace and Quorum in the County where he hath his Office. *L.*

CUSTOS *Spiritualium*, or *Cuſtos of the Spiritualities*, is he that exerciſeth Spiritual or Eccleſiaſtical Juriſdiction, in any Dioceſe, during the Vacancy of the See, which, by the Canon-Law, belongs to the Dean and Chapter; but at preſent, with us in *England*, to the Archbiſhop of the Province by Preſcription: Howbeit, divers Deans and Chapters do challenge this, by ancient Charters from the Kings of this Land. *L.*

CUSTOS *Temporalium*, the Perſon to whoſe Cuſtody a vacant See was committed by the King as ſupreme Lord, who, as a Steward of the Goods and Profits, was to give Account to the Eſcheator, and he into the Exchequer: His Truſt continued till the Vacancy was ſupplied by a Succeſſor, who obtained the King's Writ, *De Reſtitutione Temporalium*; which was commonly after Conſecration, yet ſometimes before. *L.*

CUSTUMARIUS, was an inferior Tenant in Soccage or Villenage, who, by Cuſtom, is obliged to pay ſuch and ſuch Service of Work and Labour for his Lord. Dr. *Kennet.*

To CUT *a Feather*: If a Ship hath too broad a Bow, they ſay, She will not cut a Feather; that is, ſhe will not paſs thro' the Water ſo ſwiftly, as to make it foam or froth.

CUTANEOUS *Diſtempers* [*Cutaneus, L.*] ſuch as affect the Skin, as, the Itch, or Scab, *&c.*

CUTANEOUS *Glands* and *Veſſels*, are ſuch as are placed or terminated in the *Cutis*, or Skin.

CUTICLE *Scarff-Skin*, is a Cover of the Skin without Senſe, extended outwardly over the whole Skin, like a Membrane, full of innumerable ſmall Pores, accommodated to the avoiding of Injuries from Abroad, to the ſhutting up of the Cutaneous Veſſels, and to the more accurate perfecting of Tactile Qualities: It is nouriſhed by the Blood; for if it be loſt or periſhed, it comes again, tho' its Veſſels be but little conſpicuous. *Blanch.*

Mr. *Luenhoeck* found, by his Microſcope, that the Cuticula conſiſted of an infinite Quantity of very ſmall Scales, ſo minute, that a ſmall Grain of Sand would cover near 200 of them; ſo that he thinks there are no proper Pores in the Skin, but that the Moiſture comes out under, or from between the Scales.

CUTIS, is the Skin of a living Man, but *Pellis* is that which is flead off, and it is the outermoſt Cover of the whole Body, or a pretty thick Membrane, wrought of ſeveral Filaments of the Veins and Arteries, Nerves and Nervous Fibres, complicated and interwoven with one another, full of Glandules and Lympheducts, or Veſſels that convey away the Vapours and Sweat, abounding with a great Number of Pores here and there, and ſenſibly perforated in many Places, to let in and out, as Occaſion requires; as, at the Mouth, Noſtrils, Eyes, Ears, Privities, Fundament, *&c.* it is thickeſt of all upon the Head, moderately hard in the Neck and Back, finer in the Face, Penis, and outer Skin of the Scrotum; thin on the Sides, and thinneſt of all on the Lips; in ſome Places, as the Elbow, Forehead, Soles of the Feet, it ſticks very cloſe together. *Blanch.*

CUTT-BASTION. See *Baſtion.*

CUTTER *of the Tallies*, is an Officer in the Exchequer, that provideth Wood for the Tallies, and cuts the Sum paid upon them, and then caſteth the ſame into the Court to be written upon.

CUTT-WATER, the Sharpneſs of the Head of a Ship, below the Beak; 'tis ſo called, becauſe it cuts or divides the Water before it comes to the Bow. This is called alſo the *Knee of the Head.*

CUVETTE [in *Fortification*] is a deep Trench about four Fathom broad, which is uſually ſunk in the Middle of the great dry Ditch, till you meet with Water, and ſerves both to prevent the Beſiegers Mining, and alſo the better to keep off the Enemy.

CYCLE, is a continual Revolution of certain Numbers, which ſucceſſively go on without any Interruption, from the firſt to the laſt, and then return again to the firſt, and ſo circulate perpetually. In the Kalendar there are three principal Cycles, *viz.* the *Solar*, the *Lunar*, and the *Cycle of Indiction.*

CYCLE *of the Sun*, is a Revolution of 28 Years, in which time the ſame Dominical Letter comes about again, in the ſame Order, and Leap-Years expire, and the 29th Year the *Cycle* begins again. This *Cycle* ſerves to find the Dominical Letter for any Year paſt, preſent, or to come.

To find the Cycle of the Sun.

Rule. To the Year add Nine, and divide the Sum by 28, the Remainder is the *Cycle of the Sun.*

Example.

To 1701 add 9, the Sum 1710 divided by 28, the Reſidue 2, is the *Cycle of the Sun.*

CYCLE *of the Moon*, is a Revolution of 19 Years, in which time the New Moons return to the ſame Days they were on before, and ſhe begins again her Courſe with the Sun. This was invented by *Meton* the *Athenian*, and is called the *Golden Number*. That which occaſioned probably the pitching upon this Number, was their Obſervations, that the Lunar Eclipſes happen nearly again on the ſame Day of the Month, 19 Years after the former; of which 'tis eaſy to give many modern Inſtances. *Enneadecaterides* is, with ſome, the Name of this *Lunar Cycle.*

CYCLE *of Indiction*, is a Revolution of three Luſtrums, or fifteen Years, after which, thoſe who uſed it began it again. This is more ancient than the precedent ones, and hath nothing to do with the Heavenly Motions, being eſtabliſhed by *Conſtantine*, *A. D.* 312. *Sept.* 24. who ſubſtituted them in the Room of the *Olympiads*. They were ſo called, according to ſome Authors, becauſe they denoted the Year that Tribute was to be paid to the Republick. To find this *Indiction*, ſubtract 312 from the Year given, and divide the Remainder by 15; and omitting the Quotient, what remains is the Year of the *Roman Indiction.*

Example, A. D. 1700
312
15)1388(92
135
38
8 = *Indiction.*

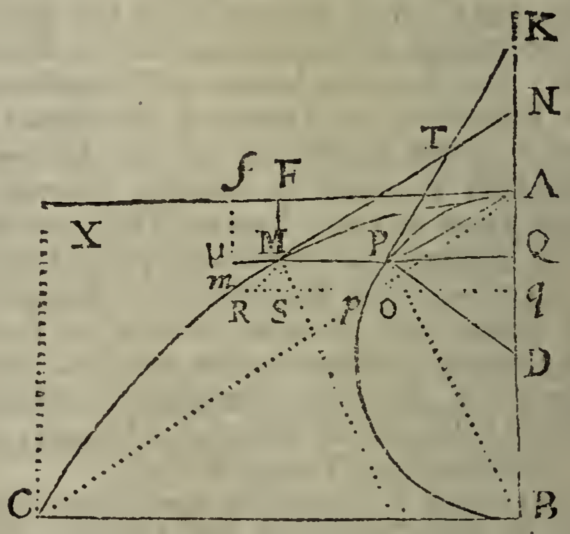
CYCLISCI [Κυκλισκοι, *Gr.*] are Surgeons Inſtruments, wherewith they ſcrape away corrupt Fleſh, or the like. They are made in the Form of a Half-Moon.

CYCLOID [κυκλοϊδὴς, of κύκλος, a Cycle, and εἶδος, Shape, *Gr.*] Beſides the Segment of the Semicycloidal Space, firſt found quadrable by Sir *Chriſtopher Wren*, and afterwards by Mr. *Huygens*, and alſo the Trilinear Part of it, which is plainly ſo; Dr. *Wallis*, in *Phil. Tranſ.* N° 217. p. 111. produces, from his Tracts *de Cycloide* and *de Motu*, ſome other Portions of the Cycloid which are capable of being ſquared. And the ſame excellent Author, in N°. 229. p. 561. ſhews, that this Figure of the Cycloid was conſidered long before the Time of *Merſennus* and *Gallileo*, tho' not thoroughly underſtood 'till this preſent Age: For in the Mathematical Works of *Bovillus*, publiſh'd at ſeveral times between 1501 and 1510, the Curve which we now call the *Cycloid*, was then conſidered; and yet not firſt by *Bovillus* neither, for Cardinal *Cuſanus*, as appears by an ancient Manuſcript of his Works, tranſlated by *J. Scoblant* in the Year 1451, had taken it into Conſideration before. Indeed the Figure, both in the Manuſcript, and in the *Baſil* Edition of his Works, is ill drawn; but being corrected by the Cardinal's own Words, it plainly repreſents the modern Cycloid.

In *Phil. Tranſ.* N°. 94. you have a Demonſtration of the Synchroniſm of the Vibrations made in a Cycloid; that is, of a Pendulum of a due Length, vibrating between two Cycloids; for ſuch a Pendulum will move in a Cycloid, and conſequently its Vibrations will be Synchronal.

To inveſtigate the Area's of Cycloidal Spaces.

Let AMC be a vulgar Semi-cycloid, and the generating Circle APB from any Point in the Ordinate, *v. g.* Q. Draw QM parallel to the Baſe BC, cutting the Periphery of the Circle in P; make the Parallelogram AFMQ, and draw fm infinitely near FM, cutting QM produced in μ, and the Curve in m. Put $AB = 2r$, $AQ = FM = x$, $\mu m = \dot{x}$, $QP = y$; then (by the Property of the Circle) $2rx - xx = yy$. Whence $r\dot{x} - x\dot{x} = y\dot{y}$, and $\dot{y} = \frac{r\dot{x} - x\dot{x}}{y}$: And becauſe the Triangles DPQ, pPO are ſimilar, therefore PQ (y) : Dp (r) : : PO $(\dot{x})$ $Pp = \frac{r\dot{x}}{y}$. Now it is the Nature of the vulgar Cycloid, that the Arch AP + the right Sine of that Arch PQ, are equal to QM: Therefore



fore it is manifeſt, that the Fluxion of the Ordinate of the Cycloid Q M, *viz.* M S, is equal to the Aggregate of the Fluxions of the Arch A P, and the Right Sine P Q; that is, $mS = Pp + po = \frac{r\dot{x} - x\dot{x}}{y} + \frac{r\dot{x}}{y} = \frac{2r\dot{x} - x\dot{x}}{\sqrt{^{2}2rx - x}}$, and conſequently the Rectangle $F\mu$ is equal to $FM \times M\mu = x \times \frac{2r\dot{x} - x\dot{x}}{\sqrt{2rx - xx}} = \frac{2rx\dot{x} - xx\dot{x}}{\sqrt{2rx - xx}} = \dot{x}\sqrt{2rx - xx}$ = to the Fluxion of the Area A M F. But the Fluxion of the Portion of the Circle APQ $= \dot{x}\sqrt{2rx - xx}$; therefore the Area A M F, and the correſponding Portion of the Circle A P Q, are always equal.

CONSECTARY I.

The Parallelogram A C is equal to the Semi-periphery A P B × A B = four times the Semi-circle A P B A, and the Complement of the Cycloidal Space A M C B to the Parallelogram, *viz.* A M C X is equal to the Semi-circle A P B A; therefore the Area of the Semi-cycloidal Space A M C B, is equal to three times the Area of the Semi-circle A P B A.

CONSECTARY II.

The Cycloidal Space, A M C B, is to the circumſcrib'd Parallelogram A C, as 3 is to 4.

CONSECTARY III.

The Space comprehended between the Chord A C, and the Curve A M C, is equal to the Area of the Semicircle A P B. For A M C B is equal to $\frac{3}{4}$ Parallelogram A C, and the Triangle A C B is = to $\frac{1}{2}$ Parallelogram A C; therefore the Space A M C A is equal to $\frac{1}{4}$ Parallelogram A C, which is equal to the Area of the Semicircle A P B, and the Space A M C A is equal to the Space A M C X = $\frac{1}{2}$ the inſcribed Triangle A C B.

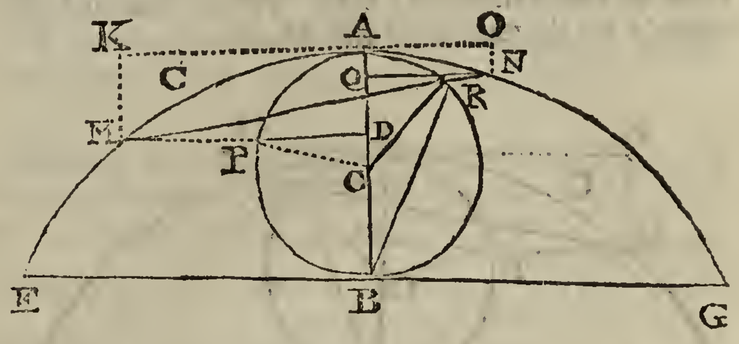
CONSECTARY IV.

Though the Quadrature of the whole Cycloidal Space, or any indefinite Portion thereof, depends on the Quadrature of the Circle; yet an infinite Number of Segments of the vulgar Cycloid, may be ſquar'd without ſuppoſing the ſame.

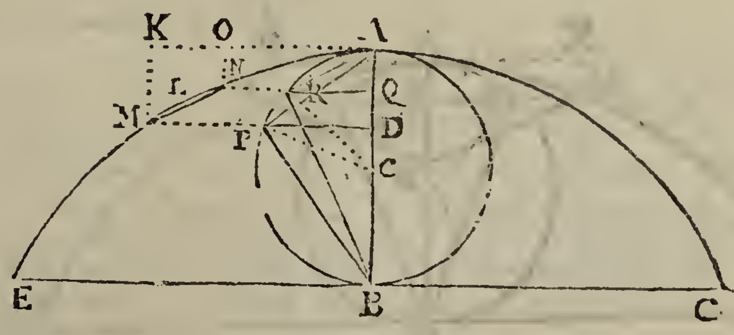
Let E A G be a Vulgar Cycloid, the Baſe E G and A B the Axis, and the Generating Circle A P B. I ſay, if the Point Q be taken at Pleaſure in the Axis A B, and if C D be taken equal to A Q, and the Ordinates, D M, Q N, and the Line M N connecting their Extremities, be drawn, the Segment of the Cycloid M E N M = Rectangle Triangle P B D + Rectangle Triangle R B Q.

Draw O A X parallel to the Baſe, and N O, M K, parallel to the Axis A B, and draw the Radii C P, C R.

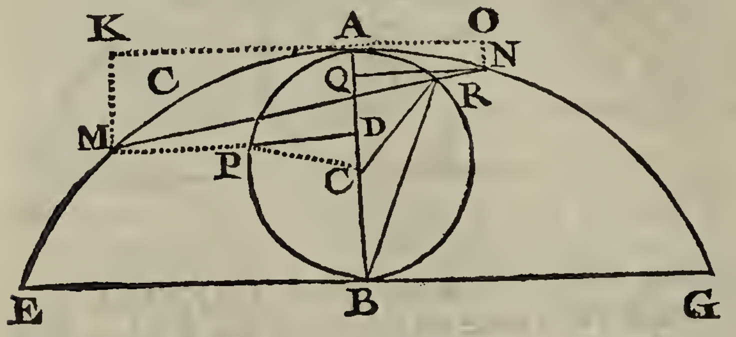
Firſt, If the Ordinates D M Q N be on the contrary Sides of the Axis A B, then the Segment *M e* M N is equal to the Trapezium M K O N — Trilineal Figures A K M and A O N. Now the Trapezium M K O N is = $\frac{1}{2}$MK + $\frac{1}{2}$N O × K O = (becauſe N O is = A Q = C D, and K M = A D) $\frac{1}{2}$C A × K O = $\frac{1}{2}$ C A × A K + $\frac{1}{2}$ C A × A O. And by the Property of the Cycloid, $\frac{1}{2}$ A C × A K, is = $\frac{1}{2}$ C A × Arch $\overline{AP + PD}$ = Sector A C P + Triangle B C P = Sector A B P. In like manner it may be demonſtrated, that $\frac{1}{2}$ C A × A O is = Sector A B R; therefore the Trapezium M K O N is equal to two Sectors, P B A = R B A. But, by the known Property of the Cycloid, the Trilineal Figure A K M is equal to the Segment of the Circle A D P, and the Trilineal Figure A O N is equal to the Segment A Q R; therefore, if from the Trapezium M K O N the Trilineal Figures, A K M, A O N, be ſubtracted, and if from the Sectors P B A, R B A, the Segments A D P, A Q R, be ſubtracted, there will remain the Segment of the Cycloid M *e* N M, equal to the Triangles P D B + B Q R.



Secondly, But if the Ordinates, Q N, D M, be on the ſame Side of the Axis A B, then the Segment of the Cycloid M *e* N M = Trapezium M K O N + Trilineal Figure A O N — Trilineal Figure A K M, Now the Trapezium M K O N = $\frac{1}{2}$ $\overline{MK + \frac{1}{2}ON}$ × O K = $\frac{1}{2}$ C A × A K — $\frac{1}{2}$ C A × A O = Sector P B A — Sector R B A; therefore if we ſubſtitute the circular Segments, A D P, A Q R, in the Place of the Trilineal Spaces, AKM, A O N, we ſhall have the Cycloidal Segment, M *e* N M = Sector P B A — Sector R B A + Segment A Q R — Segment A D P = Rectangle Triangle P D B — Rectangle Triangle R B Q.

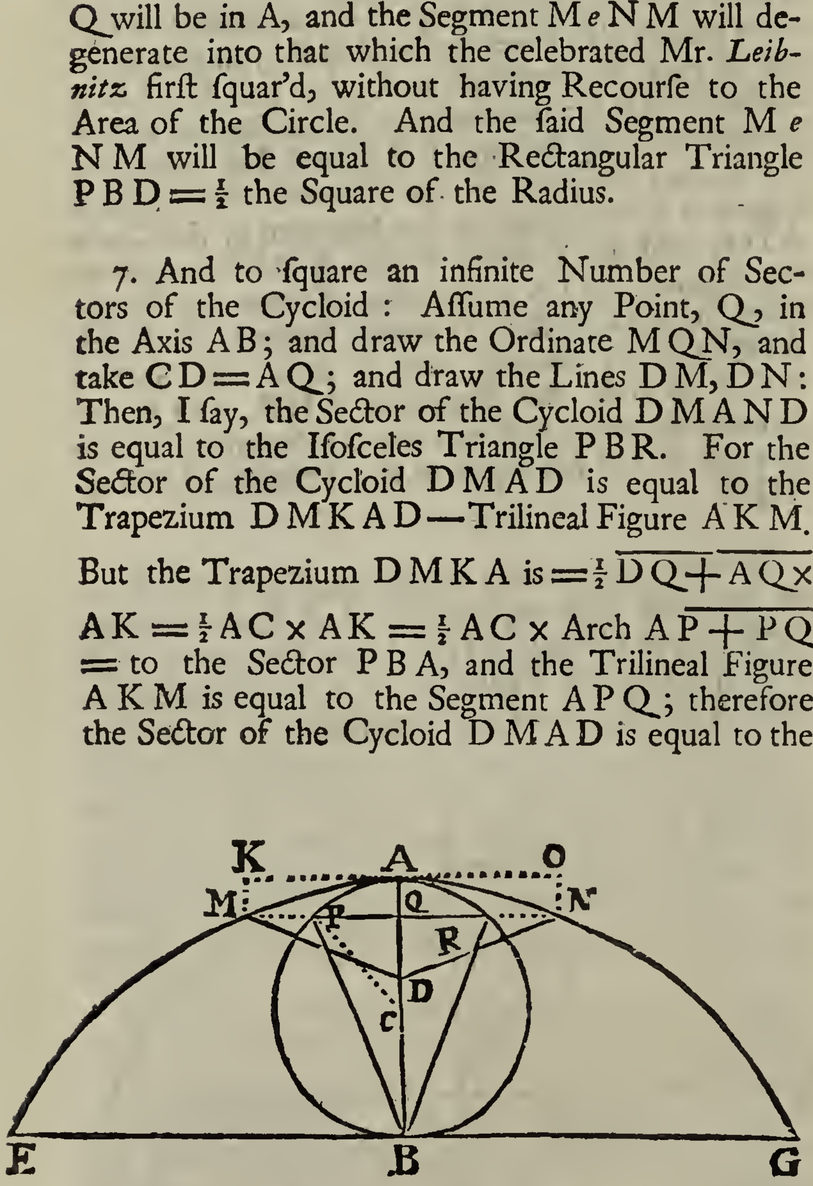


5. If the Points D and Q coincide, then it is manifeſt, that B D or B Q $=\frac{1}{2}$ B C, and the Chord M N is perpendicular to the Axis A B, and the Segment M *e* A N M will be equal to an Equilateral Triangle inſcrib'd in the generating Circle, and Space M P B A M, will be equal to three times the Area of the Triangle C P B. Which was firſt diſcover'd by the excellent Mr. *Hugens.*

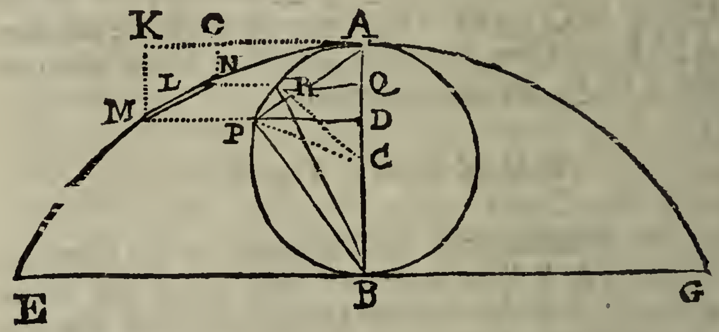


6. But if the Point D fall in the Centre, then Q will be in A, and the Segment M *e* N M will degenerate into that which the celebrated Mr. *Leibnitz* firſt ſquar'd, without having Recourſe to the Area of the Circle. And the ſaid Segment M *e* N M will be equal to the Rectangular Triangle P B D $=\frac{1}{2}$ the Square of the Radius.

7. And to ſquare an infinite Number of Sectors of the Cycloid : Aſſume any Point, Q, in the Axis A B; and draw the Ordinate M Q N, and take C D = A Q; and draw the Lines D M, D N: Then, I ſay, the Sector of the Cycloid D M A N D is equal to the Iſoſceles Triangle P B R. For the Sector of the Cycloid D M A D is equal to the Trapezium D M K A D — Trilineal Figure A K M. But the Trapezium D M K A is $=\frac{1}{2}\overline{DQ+AQ}\times AK=\frac{1}{2}AC\times AK=\frac{1}{2}AC\times$ Arch $\overline{AP+PQ}$ = to the Sector P B A, and the Trilineal Figure A K M is equal to the Segment A P Q; therefore the Sector of the Cycloid D M A D is equal to the Triangle P B Q; and conſequently the Sector of the Cycloid D M A N D is equal to the Iſoſceles Triangle B P R.



8. And as we have thus ſquared an infinite Number of Cycloidal Segments and Sectors; ſo an infinite Number of Cycloidal Zones (*viz.* Spaces comprehended between the Portion of the Curve M N, the Portion of the Axis Q D, and the Ordinates Q N, D M) may be ſquared from the ſame Principles: For if we conſider that the external Space A K M is equal to the Segment of the Circle A P D, and that A P = M P, we may find the Value of any Cycloidal Space in Rectilineal Figures and Circular Segments; and therefore, if it be required that the ſaid Cycloidal Space ſhould be ſquarable, 'tis plain that thoſe Terms which conſiſt of circular Segments, muſt deſtroy one another, and conſequently be put = o; from which Suppoſition, the Quantities which were aſſumed at firſt, may eaſily be determined; *ex. gr.* Let it be required to determine the Right-lines, C Q, C D, in the Axis A C; ſo that the Cycloidal Zone D M N Q be ſquarable. Suppoſe A C $=a$, C Q $=x$, C D $=z$, Q R $=p$, D P $=q$, A R or N R $=u$, A P or M P $=e$; then the Sector A C R $=\frac{1}{2}au$, and the Sector A C P $=\frac{1}{2}ac$, and conſequently the Segment A Q R, or the Figure A O N, is = A C R — C Q R $=\frac{1}{2}au-\frac{1}{2}px$; and the Segment A D P, or the Figure A K M, is = A C P — C P D $=\frac{1}{2}ac-\frac{1}{2}qz$. But the Cycloidal Segment A Q N is $= QO - AON = QO - AQR = AQ\times\overline{QR+RN}-AQR = AQ\times\overline{QR+AR}-AQR=\overline{a-x}\times\overline{p+u}-\frac{1}{2}au+\frac{1}{2}px=ap-\frac{1}{2}px+\frac{1}{2}au-xu.$



And in like manner the other Segment A D M is $=aq-\frac{1}{2}qz+\frac{1}{2}ac-zc.$

And conſequently the Zone D M N Q = A D M — A Q N is $=aq-\frac{1}{2}qz-ap+\frac{1}{2}px+\frac{1}{2}ac-zc-\frac{1}{2}au+xu.$

Whence it appears, that the four firſt Members conſiſt of Rectilineal Figures only, and that the other Terms affected with *u* and *c*, hinder the Zone from being ſquarable. Whence it is evident, that if we ſuppoſe the Terms affected with *u* and *c*, mutually deſtroy one another, then the Cycloidal Zone D M N Q will be $=aq-\frac{1}{2}qz-ap+\frac{1}{2}px$. And the remaining Terms muſt be = o; that is, $\frac{1}{2}ac-zc-\frac{1}{2}au+xu=0$; and if we ſuppoſe the Ratio of *c* to *u* be given (that is, as one Number is to another, that ſo one Arch being given, the other may be constructed Geometrically) we may deſtroy the Quantities *c* and *u*, and find the Relation between *z* and *x*; *v. gr.* If it be $u:c::1:2$, then the Equation $\frac{1}{2}ac-zc-\frac{1}{2}au+xu=0$, becomes $a-2z-\frac{1}{2}a+x=0$; and conſequently $z=\frac{a+2x}{4}$. And if $u:c::1:3$, then $z=\frac{2a+2x}{6}$; or if it be $u:c::1:4$, then $z=\frac{3a+2x}{8}$, *&c.* in the ſame Progreſſion.

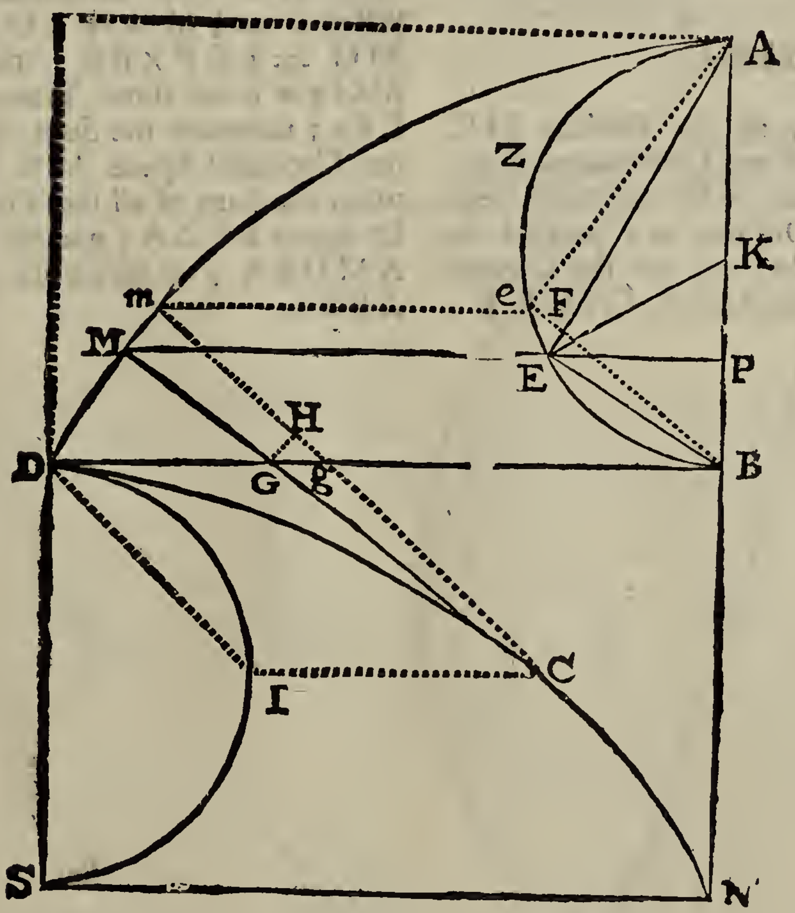
And to find the Value of *z* in other Terms; if we ſuppoſe C Q the Sine Complement of the Arch A R to be given, then C D the Sine Complement of Double, Triple, Quadruple, *&c.* that Arch may be found by common Algebra. Therefore, if *c* be $=2u$, then $z=\frac{2xx-aa}{a}$; if $c=3u$, then $z=\frac{4x^3-3aax}{aa}$; or if $c=4u$, then $z=\frac{8x^4-8aaxx+a^4}{a^2}$, *&c.* and comparing theſe

Values of z with thoſe formerly found, we may find the Value of x in any Suppoſition. *V. g.* If c be $= 2u$, then $z = \frac{a+2x}{4} = \frac{2xx-aa}{a}$; and conſequently $8xx + 2ax = 5aa$. Whence x is $= -\frac{1}{8}a + \sqrt{\frac{5}{8}aa + \frac{1}{64}aa} = \frac{1}{8}a + \sqrt{\frac{41}{64}aa} = \frac{1}{8}a + \frac{1}{8}a\sqrt{41}$.

Hence it is manifeſt, that if C Q be taken equal $\frac{1}{8}a + \frac{1}{8}a\sqrt{41}$. And if the Ordinate Q N be applied to the Axis in the Point Q, and if the Arch R P be taken = A R, and the Ordinate M P D be drawn; then the Cycloidal Zone D M N Q will be $= aq - \frac{1}{2}qz - ap + \frac{1}{2}px =$ the Rectilineal Triangles C A P + D A P — C A R — A Q R.

And thus an infinite Number of Cycloidal Zones may be determined, which admit of a Quadrature, when the Proportion between the Arches A R, R P, is expreſſed in given Numbers.

If the Curve-line A M D *be a ſimple Semicycloid, whoſe Baſe* B D *is equal to the Semiperiphery of the Generating Circle* B E A. *'Tis required to find the Value of the Ray of the Evoluta* M C.



Suppoſe A P = x, P M = y, the Arch A E = u; and the Diameter A B = $2a$; then, by the Property of the Circle, P E is $= \sqrt{2ax - xx}$, and by the Property of the Cycloid $y = u + \sqrt{2ax - xx}$; therefore $\dot y = \dot u + \frac{a\dot x - x\dot x}{\sqrt{2ax - xx}}$: But $\dot u$ equal $\frac{a\dot x}{\sqrt{2ax - xx}}$; therefore $\dot y = \frac{2a\dot x - x\dot x}{\sqrt{2ax - xx}} = \dot x \times \frac{2a - x}{\sqrt{2ax - xx}} = \dot x \times \frac{2a - x}{\sqrt{x} \times \sqrt{2a - x}} =$ (dividing by $\sqrt{2a - x}$) $\dot x \times \frac{\sqrt{2a - x}}{x}$; whence $\ddot y =$ (ſuppoſing $\dot x$ invariable) $\frac{-a\dot x^2\sqrt{x}}{xx\sqrt{2a - x}} = \frac{-a\dot x^2}{x\sqrt{2ax - xx}}$; and ſubſtituting this Value in the General Theorem $\frac{\overline{\dot x^2 + \dot y^2}\sqrt{\dot x^2 + \dot y^2}}{-\dot x\ddot y}$, or $\frac{\overline{\dot x^2 + \dot y^2}|^{\frac{3}{2}}}{-\dot x\ddot y}$ we ſhall have (becauſe $\dot y = \dot x\frac{\sqrt{2a - x}}{x}$)

$$\frac{\overline{\frac{2a\dot x_2}{x}}\Big|^{\frac{3}{2}}}{-\dot x\ddot y} = \frac{\sqrt{\frac{8a^3\dot x^6}{x^3}}}{-\dot x\ddot y} = \frac{\sqrt{\frac{8a^3\dot x^6}{x^3}} \times x\sqrt{2ax - xx}}{a\dot x^3}$$

$$\frac{\sqrt{\frac{8a^3}{x^3}} \times x\sqrt{2ax - xx}}{a} = \frac{\sqrt{\frac{16a^4x^3 - 8a^3x^4}{x^3}}}{a}$$

$2\sqrt{4aa - 2ax} =$ MC $= (2\sqrt{EPq + PBq} =$ 2 E B) = 2 M G; becauſe M C perpendicular to the Curve in the Point M, is parallel to the Chord B E.

CONSECTARY I.

If x be ſuppoſed = 0, then is A N $= 2\sqrt{4aa} = 4a =$ to the Ray of the Evoluta in the Vertex A; and if we ſuppoſe $x = 2a$, then M C $= 2\sqrt{4aa - 4aa} = 0$; that is, the Ray of the Evoluta in D is = to nothing; and in A it is equal to twice the Diameter of the Generating Circle; and hence 'tis evident, that the Evoluta begins in D and ends in N; ſo that B N is = B A.

CONSECTARY II.

The Evoluta D C N is a Semicycloid equal to the given Semicycloid D M A: Compleat the Parallelogram B S, and on the Diameter D S deſcribe the Semicircle D I S, and draw D I parallel to M C parallel to BB; then is the Angle $BDI = EBD$; and conſequently the Arches, DI, BE, are equal: But $EB = MG = GG$; therefore $GC = DI$; and if IC be drawn, it will be equal and parallel to DG. Now, by the Nature of the Cycloid DG = Arch EB = Arch DI; therefore IC is = Arch DI; and conſequently the Evoluta DCN is a Semicycloid, whoſe Baſe is $SN = \frac{1}{2}$ the Periphery of the Generating Circle DIS; that is, the Evoluta is equal to the given Cycloid, and the ſame with it, only placed in a contrary Poſition.

CONSECTARY III.

The Length of the Curve of the Cycloid DCN is $= 2\,AB$ (= twice the Diameter of the Generating Circle) and any Portion of the Cycloid, as DC, is $= 2\,CG = 2\,DI$ = twice the correſponding Chord in the Generating Circle.

Another Solution.

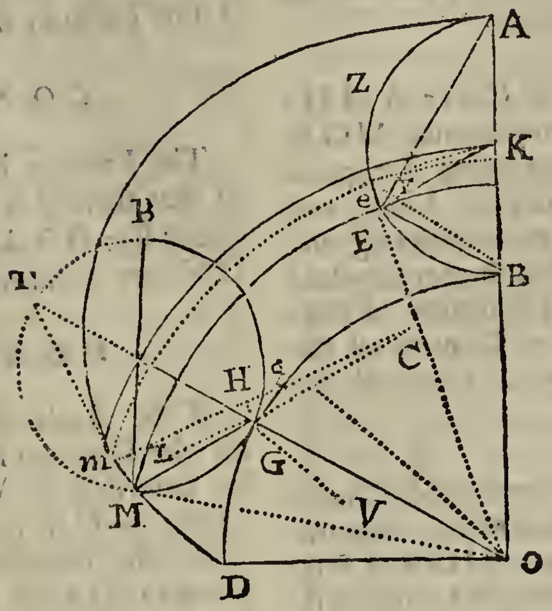
The Length of the Ray of the Evoluta MC may be determined without any Calculation, thus: Draw another Perpendicular, mC, infinitely near the former, and another Ordinate me parallel to ME, and another Chord Be; and on the Centres C and B, deſcribe the little Arches, GH, EF; then the Rectangular Triangles, GHg, EFe, will be ſimilar and equal; for Gg is $= Ee$ (becauſe BG or ME is = Arch AE, and Bg or me is = Arch Ae) and Hg or $mg - MG = Fe$ or $Be - BE$, and (47 *Elem.* 1.) $GH = EF$. Now the Angle MCm is $= EBe$ (becauſe the Perpendiculars, MC, mC, are parallel to the Chords, EB, eB; and GH, EF: The Arches that meaſure thoſe equal Angles, are equal; therefore the Radii, CG, EB, are alſo equal; and conſequently MG is $= GC$: Whence 'tis evident, that the Ray of the Evoluta MC is = twice the Chord $BE = 2\,MG$.

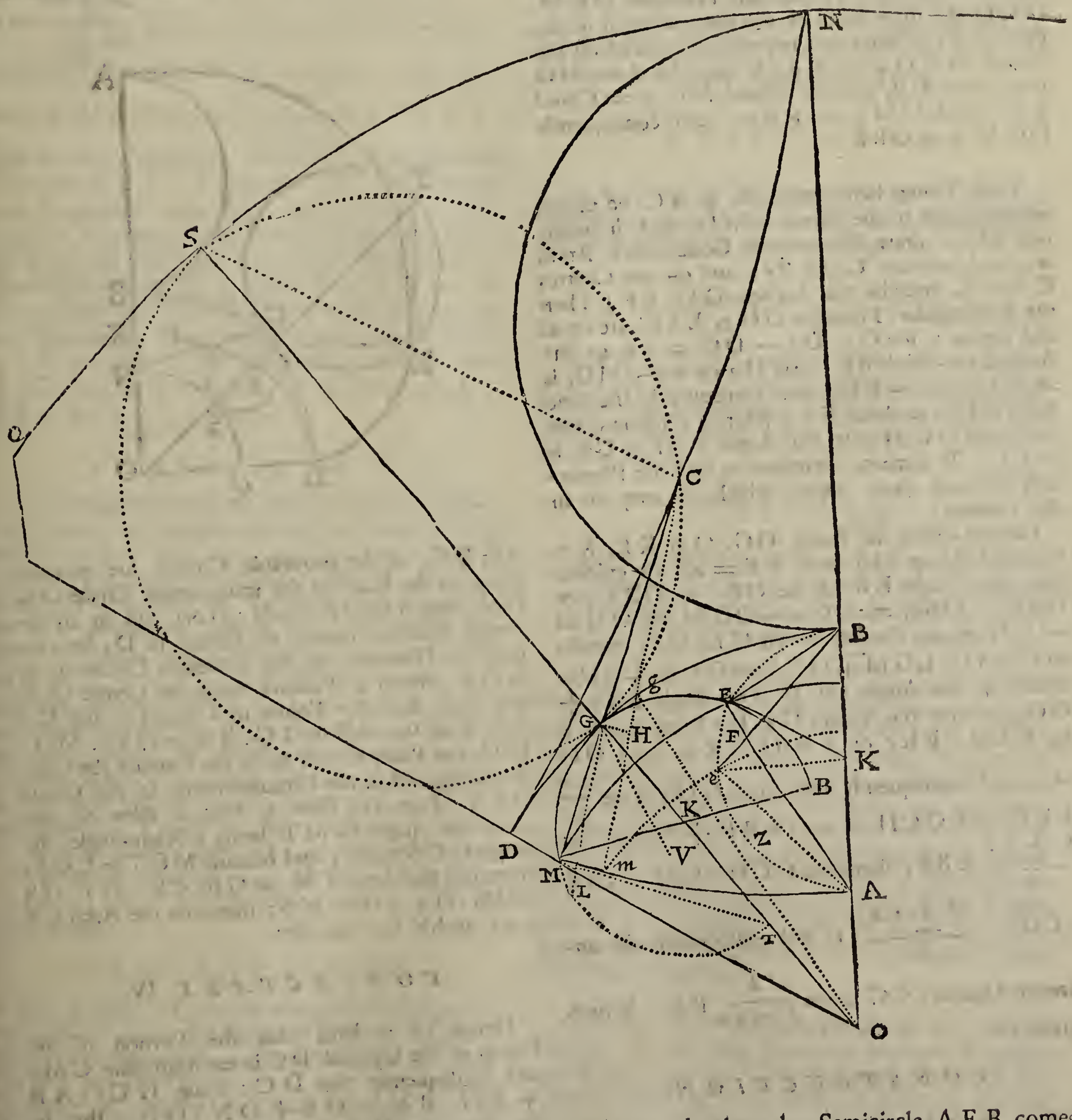
CONSECTARY.

We have proved before, that the Area of the Cycloid is triple the Area of the Generating Circle: This Truth may be proved from other Principles, as thus; the Space $MGgm$, or the Trapezium $MGHm$ (the Difference being incomparably little) is $= \frac{1}{2}\,Mm + \frac{1}{2}\,GH \times MG = \frac{3}{2}\,GH \times MG = \frac{3}{2}\,EF \times BE$; that is, the Trapezium $MGgm$ is = three Times the Sector EBF or EBe; therefore the Sum of all the Trapezia, *viz.* the Cycloidal Space $MGBA$ is equal to three times the Sum of all the Triangles, *viz.* the Circular Space $BEZA$; and the whole Cycloidal Space $AMDBA$ is = thrice the Area of the Semicircle $AEBA$.

Prop. XIII.

If the Curve AMD *be a Semicycloid deſcrib'd by the Revolution of the Semicircle* AEB, *on the Periphery of another immovable Circle* BDG. *'Tis required to deſcribe the Evoluta of the ſaid Curve.*





The moveable, or generating Circle, may be ſuppoſed to move either on the Convex or Concave Side of the Periphery of the immovable Circle; and when the Semicircle A E B comes into the Poſition M G B, in which Poſition it touches the Baſe B D in G, and the deſcribing

Point A, is in M, in the Curve of the Cycloid; then from the Geneſis of the Curve I infer,

1. The Arch G M is = Arch G D, and the Arch G D of the moveable Circle is equal to the Arch G B of the immovable Circle.

2. MG is perpendicular to the Curve A M D; for if we conſider the Semi-circumference M G B, or A E B, and the Baſe B G D, as being compos'd of an infinite Number of little ſtreight Lines, and every one in one, equal to the correſponding one in the other, 'twill be manifeſt, that the Semicycloid A M D is compos'd of an infinite Number of Circular Arches, which have for their Centres all the Points of Contact G ſucceſſively, and are all deſcrib'd by the ſame Point M.

3. If on O, the Centre of the immovable Circle, the Concentrick Arch M E be deſcribed, then the Arches of the moveable Circle, *viz.* M G and E B, will be equal; and alſo the Chords M G and E B, and the Angles, O G M, O B E, will be equal between themſelves: For in the Triangles, O K M, O K E, the three Sides of the one are equal to the three Sides of the other reſpectively; therefore the Angles M K O is = E K O, and the Arch M G is = Arch E B, and the Chord M G is = Chord E B, and K G M is = K B *w*; and conſequently O G M is = O B E.

Theſe Things being premis'd, let *m* C be drawn perpendicular to the Curve A M D, and infinitely near M C; draw alſo another Concentrick Arch, *m e*, and another Chord B *e*; and on the Centres C and B, deſcribe the Arches, G H, E F; Then the Rectangular Triangles G H *g*, E F E, are equal and ſimilar; for G *g*, D *g* — D G = E *e*, or the Arch B *e* — Arch B E; and H *g* or *m g* — M G, is = F *e* or B *e* — B E; and conſequently the little Arch G H is = Arch E F; whence it follows, that the Angle G C H is to the Angle E B F as C E is to C G. It remains therefore to find the Proportion between thoſe Angles, which we may do in this manner:

Having drawn the Radii, O G, O *g*, K E, K *e*, ſuppoſe O G or O B = *b*, K E = *a*, 'tis evident that the Angle E B *e* is = O B *e* — O B E (or O B E — O B *e*) = O G *m* — O G M (or O G M — O G *m*) = (having drawn G L, G V, parallel to C *m*, O *g*) L G M $\mp$ O G V = G C H $\mp$ G O *g*; therefore the Angle G C H is = Angle E B *e* $\pm$ G O *g*. Now the Arches G *g*, E *e* being equal, it is, G O *g* : E K *e* or 2 E B F : : K E (*a*) : O G (*b*); and conſequently the Angle G O *g* is = $\frac{2a}{b}$ E B F, and G C H is = (E B F + G O *g*) = $\frac{b \pm 2a}{b}$ E B F; therefore G C H : E B F (: : A E : C G) : : $\frac{b \pm 2a}{b}$: 1, and conſequently the unknown Quantity C G is = $\frac{b}{b - 2a}$ B E: Which gives this

CONSTRUCTION.

Say, As O A ($b \pm 2a$) : O A (b) : : B E or M G : G C; then the Point C will be in the Evoluta requir'd.

CONSECTARY I.

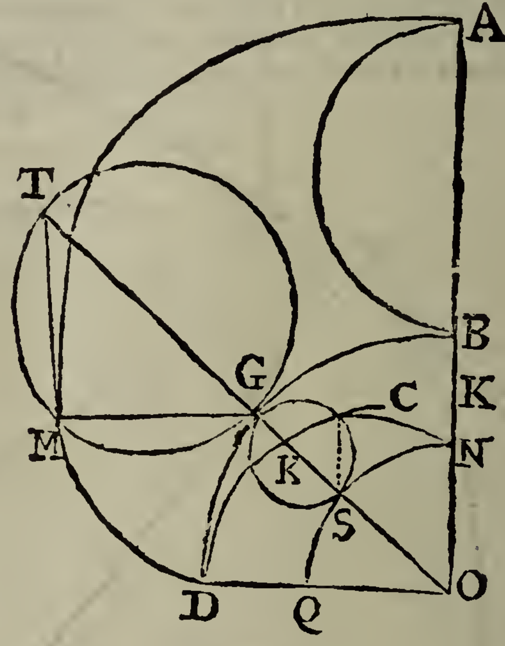
The Evoluta begins in the Point D, and touches the Baſe B G D in D; for the Chord G M (the Third Term in the Analogy) vaniſhes in that Point.

CONSECTARY II.

The Evoluta D C N terminates in the Point N; ſo that then O A : O B : : A B : B N : : O A $\pm$ A B (= O B) : O B + B N (= O N); that is, O A, O B, O N, are continually proportional.

CONSECTARY III.

If the Arch of the Circle N S Q be deſcribed on the Centre O, I ſay the Evoluta D C N may be deſcrib'd by the Revolution of the moveable Circle G C S (whoſe Diameter is G S = B N) about the immoveable Circle N S Q; that is, the Evoluta D C N is a Semicycloid, ſimilar to the given Semicycloid A M D (becauſe the Diameters A B, B N, of the moveable Circles, are proportional to the Radii of the immoveable Circles O B, O N; for A B : O B : : B N : O N) and in an inverted Poſition, having its Vertex in D; for ſuppoſe the Diameters of the moveable Circles to be in O T (drawn at Pleaſure from the Centre O) it will paſs thro' the Points of Contact S and G; then if we ſay, A B or T G : B N or G S : : M G : G C, the Point C will be in the Evoluta (by Conſtruction) and in the Circumference of the Circle G C S (*Prop.* 31. *Elem.* 3. *Prop.* 6. *Elem.* 6.) becauſe the Angle G M T being a Right-angle, the Angle G C S is alſo; and becauſe M G T = C G S; therefore the Arch T M (= G B) C S : : G T : G S : : O G : O S : : G B : N S; therefore the Arch C S is = Arch N S; *ergo*, &c.



CONSECTARY IV.

Hence 'tis evident, that the Portion of the Curve of the Cycloid D C is = Right-line C M; and conſequently that D C : Tang. G C : : A B + B N : B N : : O B + O N : O N; that is, the Sum (or Difference) of both Diameters (of the moveable and immoveable Circles) is to the Semidiameter of the immoveable Circle, as D C is to the Tangent CG; for the Triangles C Mm, CGH are ſimilar, therefore Mm : GH or EF :: MC : GC :: (by Conſtruct.) OA + OB ($2b + 2a$) : (See *Fig.* 2. in Page the laſt but one) OB (b) and conſequently the Sum of all the Mm, or the Portion of the Cycloid AM, is to the Sum of all the EF, or Chord AE, or Tangent TM, as OA + OB is to OB; whence 'tis evident, that OB : OA + OB (= 2 OK) :: AB : AMD, and OB : 2 OK :: AB — AE : DM :: twice the verſed Sine of half the Angle MKG or EKB : the Portion of the Curve DM.

And becauſe it is AM : Tang. TM :: OA + OB : OB; therefore in the vulgar Cycloid, AM : Tang. TM :: 2 : 1.

CONSECTARY V.

The Trapezium MGHm is $= \overline{\tfrac{1}{2}GH + \tfrac{1}{2}Mm} \times MG$; but CG ($= \frac{b}{\overline{b + 2a}}$ MG : CM ($= \frac{\overline{2b + 2a}}{\overline{b + 2a}}$MG) :: GH : M$m$ $= \frac{\overline{2b + 2a}}{b}$GH; therefore (becauſe) GH is = EF, and MG = EB) MGHm is $= \frac{\overline{3b + 2a}}{2b} \times EF \times EB$; that is, the Trapezium MGHm : correſponding Triangle EBF :: $\overline{3b + 2a} : b$. And becauſe the Proportion univerſally obtains, 'tis evident, that the Cycloidal Space MGBAM (See *Fig.* 2. in Page the laſt but one) (comprehended under the Right-lines MG, AB, the Baſe GB, and the Portion of the Curve AM) is to the correſponding Segment of the moveable Circle BEZAB, as $3b + 2a$ is to b; and the whole Cycloidal Space AMDBA is to the Area of the Semi-circle AEBA, as $\overline{3b + 2a}$ is to b.

CONSECTARY VI.

If we imagine OB, the Radius of the immoveable Circle, to become infinite, the Arch AGD will become a ſtrait Line, and the Curve AMD will be the Vulgar Cycloid; and in this Caſe AB, the Diameter of the moveable Circle, is = 0, in reſpect of that of the immoveable Circle: Whence, 1. becauſe $b + 2a$ is $= b$, it is MG : GC :: $b : b$; that is, MG is = GC, and conſequently if BN be taken = AB, and NS be drawn parallel to BD, the Evoluta DCN will be generated by the Revolution of a Circle (on the Baſe NS) whoſe Diameter is = AN. 2. The Portion of the Cycloid AM, is to the correſponding Chord of the Circle AE :: $2b : b$; this is evident from §. 4. of *Hayes's Fluxions*. 3. The Space MGBA is to the Segment BEZA :: $3b : b$; which is alſo evident from § 5. of the ſame Book.

CONSECTARY VII.

The Length of the Semi-cycloidal Curve is proportional to the Rectangle BKO, if the Semi-diameter of the immoveable Circle be the ſame. Let BA be the Diameter of one, and Ba the Diameter of another moveable Circle; and let OB be the Radius of the immoveable Circle common to both: Then, by §. 4.

OB : OA + OB :: AB : AMD;

And OB : Oa + OB :: aB : amd;

And by Proportion of Equality and Div. } OA + OB : Oa + OB :: aB × AMD : AB × amd

That is, 2 OK : 2 ok :: aB × AMD : AB × amd

Whence OK × AB : ok × aB :: AMD : amd;

And dividing by 2, BKO : BkO :: AMD : amd. *Q. E. D.*

CONSECTARY VIII.

Becauſe the Arches GD, GM, are always equal between themſelves, it follows that the Angle DOG : Angle GKM :: GK : OG; therefore if the Point D, (where the Cycloid begins) the Radii OG, GK, and the Point of Contact G be given, the Poſition of the Point M, which deſcribes the Cycloid, is found by drawing the Ray KM; ſo that GK : GO :: DOG : GKM; and all the Points of the Curve AMD may be determined Geometrically, when the Proportion between the Radii OG, GK can be expreſſed in Numbers; and conſequently, in that Caſe, this Cycloid is a Geometrical Curve, and the ſaid Cycloid is a Tranſcendent (or Mechanick) Curve, when the Relation of OG to OC cannot be expreſſed by any finite Number of Terms.

CONSECTARY IX.

If in Concentrick Spheres ſimilar Cycloids be deſcribed, their Perimeters will be proportional to the Semi-diameters of the ſaid Spheres.

CONSECTARY X.

And becauſe the Length of the Curve of the Cycloid AMD is proportional to the Rectangle BKO, 'tis plain, that in Vulgar Cycloids the Curve is proportional to the Diameter of the Generating Circle.

SCHOLIUM.

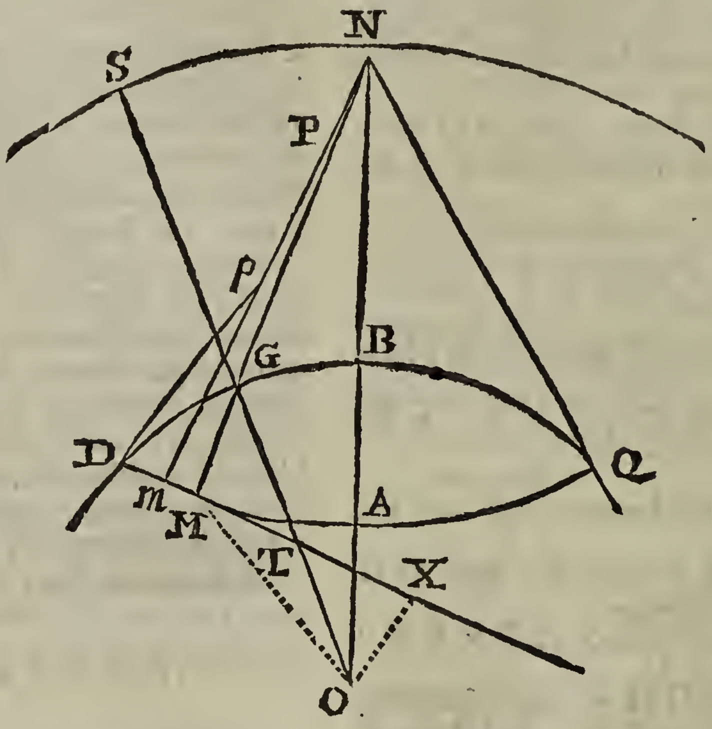
By help of ſuch Principles as theſe, the Great Sir Iſaac Newton *has advanced ſeveral wonderful Concluſions concerning the more exact meaſuring of Time by Pendulums: As for Inſtance,*

1. If within the Globe BGD the Cycloid DAQ be deſcribed, being biſected in A, and terminated in the Surface of the Globe in D and Q, and if OA be produced (biſecting DQ in B) unto N, ſo that OA, OB, ON ∺ and the Globe NS be deſcribed on the Centre O, and the Semi-cycloids ND, NQ be deſcribed within the ſaid Globe; then a Pendulum ſuſpended to the Point N, and equal to NA, will vibrate in the Cycloid DAQ, the ſame being deſcribed by the Evolution of the Cycloidal Cheeks ND, NQ. And thus a Pendulum may be made to vibrate in any ſuch given Cycloid.

2. If the ſaid Pendulum vibrate in the Cycloid DAQ by the ſole Force of its own Gravity, and if the Force of Gravity in every Point of the Curve DAQ be as its Diſtance from the Centre O, then the Vibrations (equal or unequal) of the Pendulum, will be performed in equal times.

Let MT touch the Cycloid *in* M, and draw OX perpendicular to MX; then, becauſe the

Force of Gravity is as O M, it may be reſolved into the Parts O X, M X. Now 'tis evident, that the Force O X, being parallel to the Thread P M, has no other Effect but to diſtend the ſame, and is totally deſtroyed by its Reſiſtance; therefore the Force M X only accelerates the Motion of the Pendulum M in the Cycloid, and the Acceleration of the Pendulum in the Cycloid is always proportional to this accelerating Force. Now the Triangles O X T, M G T are ſimilar, and O T and G T are invariable Quantities; therefore M X is always proportional to M T, and M T is proportional to the Curve of the Cycloid M A: Therefore if two Pendulums N P M, N*p m* be demitted from M *m* at the ſame Inſtant of Time, they will be accelerated in Proportion to the Arches M A, *m* A, they have to deſcribe; and conſequently the Portion of the Curve which they deſcribe in the Beginning of their Motion, will be proportional to the Arches M A, *m* A; and the Portions yet to be deſcribed, or the accelerating Forces, will be proportional to the ſaid Arches M A, *m* A. Whence 'tis manifeſt, that the Portions to be deſcribed, being always in the ſame Proportion of M A to *m* A, muſt vaniſh at the ſame time; that is, the Pendulums demitted from M, *m*, at the ſame Inſtant of Time, and deſcending in the Curve M A, *m* A, by the Force of their own Gravity, will arrive in the Point A together. And again, If we ſuppoſe the Pendules to aſcend from A towards Q, with the Velocities which they have acquired *m* A, they will then be retarded every where, whereby the ſame Forces which accelerated their Motions before, and conſequently the Velocities of the Pendulum's aſcending and deſcending in the ſame Arches, will be the ſame, and the Arches themſelves will be deſcribed in the ſame time; whence it appears, that the whole Vibrations, as well as the Semi-vibrations, will always be Iſochronal.



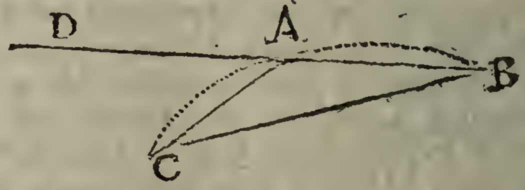
3. And if O, the Centre of Attraction, be ſuppoſed at an infinite Diſtance from B, then the Curve D A Q (in which the Pendulum vibrates) will be a Vulgar Cycloid, and the Force of Gravity will always be the ſame in all Places of the Curve. And the Vibrations in this alſo will be Iſochronal, for D B Q will become a ſtrait Line, and G T and M O will be parallel to B A; whence, if M O be a determinate Quantity, and repreſent the Force of Gravity, then M X, or M T, or M A, will repreſent the accelerating Force in the Cycloid, &c. *Ergo,*

The ſame Excellent Perſon has enriched this Theory with many more ſublime Diſcoveries, which for Brevity's Sake, I omit; this being ſufficient to give the unacquainted Reader a Taſte of the Uſefulneſs of the Doctrine concerning the Rectification of the Curves.

L E M M A.

In every Triangle B A C, *if the Angles* A B C, A C B, *and* C A D *the Complement of the Obtuſe Angles* C A B *to two Right-angles, be infinitely little; I ſay, they are proportional to their oppoſite Sides* A C, A B, B C.

For if a Circle be circumſcribed about the Triangle A B C, the Arches A C, A B, B A C, which meaſure double the ſaid Angles, will be infinitely little alſo, and conſequently they will be equal to their Chords or Subtendents.



And if the Sides A C, A B, B C of the Triangle A B C be finite Quantities, 'tis plain that then the circumſcribed Circle muſt be infinitely great, that ſo the Arches A B, A C, may be infinitely little in reſpect of the whole Circumference.

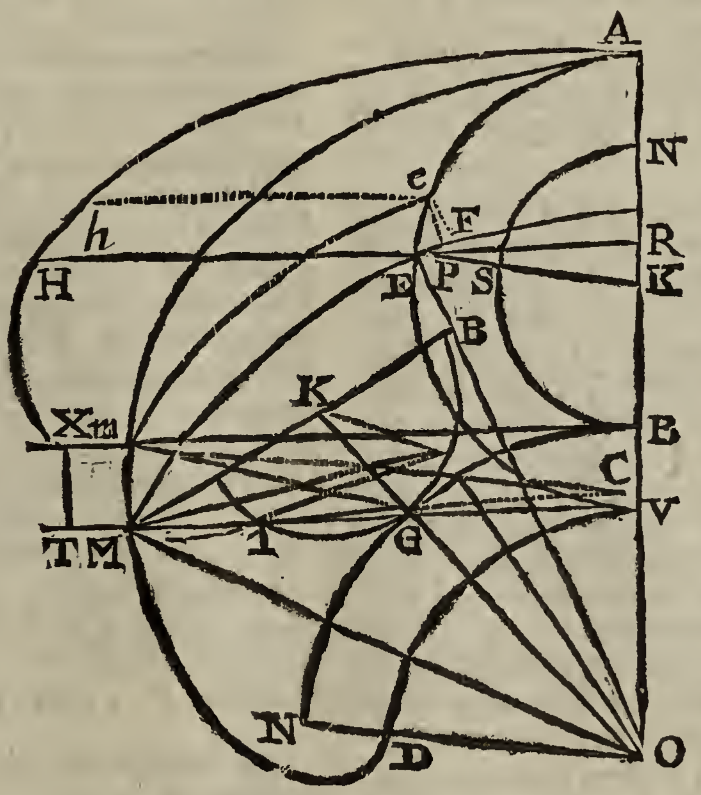
P R O P. XIII.

If A M D *be a Semi-cycloid deſcribed by the Semicircle* B S N, *revolving on the immoveable Arch* B G N, *ſo that the Evoluta or Arches* B G, B G, *be always equal to one another; and if* A, *the Point*

Point which deſcribes the Curve, be in the Diameter BN, *within or without the Periphery of the moveable Circle : 'Tis required to inveſtigate the Value of the Ray of the Evoluta* MC.

Imagine another Perpendicular mg infinitely near MG, interſecting MG, produc'd in C, the Point requir'd. Draw the Right-line Gm, and take Gg on the moveable Circle = Gg on the immoveable Circle, (ſee the following Fig.) and draw the Lines Mg, Ig, Kg, Og. Now if we conſider the little Arches Gg, Gg is perpendicular to the Radii Kg, Og, then 'tis manifeſt, that the little Arch Gg of the moveable Circle falling on the Arch Gg of the immoveable Circle, the Point M will fall on m, ſo that the Triangle CMg will exactly cover the Triangle CMg: Whence it is evident, that the Angle MGm is = gGg, = (becauſe, adding to both the ſame Angles KGg, OGg, their Sum will be equal to two Right-angles) = GKg + GOg.

Now if we ſuppoſe OG = b, KG = a, GM, or Gm = r, and GI or Ig = q, then it will be, 1. OG : GK : : GKg : GOg, and OG (b) : OG + GK (= OK = $a+b$) : : GKg : GKg + GOg or gGg or MGm = $\frac{a+b}{b}$ GKg. 2. Ig : MI : : GMg : MGI, and by Compoſition Ig + MI or MG (r) : Ig (q) : : GMg = MgI or GIg = $\frac{1}{2}$GKg : GMg or Gmg = $\frac{q}{2r}$GKg. 3. MCm or MGm, MGm − Gmg ($\frac{2ar+2br-bq}{2br}$ GKg) : Gmg ($\frac{q}{2r}$ GKg) : : Gm (r) : GC = $\frac{bqr}{2ar+2br-bq}$, and conſequently the Ray of the Evoluta MC is = $\frac{2arr+2brr}{2ar+2br-bq}$.



And if we ſuppoſe OG (b) the Radius of the immoveable Circle, to become infinite, the Circumference BGN will become a ſtrait Line, and the Terms $2arr$ and $2ar$ will vaniſh in reſpect of the others, and the Value of the Ray of the Evoluta MC will be = $\frac{2brr}{2br-bq} = \frac{2rr}{2r-q}$.

CONSECTARY.

Hence to find the Area of the Cycloidal Space MCB, the Quadrature of the Circle being ſuppoſed; becauſe Sectors of Circles are in a Ratio compounded of the Duplicate Ratio of the Radii and the ſimple Ratio of their included Angles; it is, Angle GMg ($\frac{q}{2r}$ GKg) : Angle MGm ($\frac{a+b}{b}$ GKg) : : the little Triangle (or Sector) MGg (whoſe Baſe is Ggm the moveable Circle) : to the little Triangle or Sector GMm. Whence the Sector GMm is = $\frac{2r}{q}\times\frac{a+b}{b}$ MGg = (ſuppoſing MI = s, and conſequently $r = s +$ n) = $\frac{2a+2b}{b}$ MGg + $\frac{2as+2bs}{bq}$ MGg. Now the little Triangle or Sector KGg is to the little Triangle MGg, in a Ratio compounded of the Square of KG to the Square of MG, and the Ratio of the Angle GKg to the Angle GMg, that is, as $aa \times$ GKg to $rr \times \frac{q}{2r}$ GKg; and conſequently the little Triangle MGg is = $\frac{rq}{2aa}$ KGg, and ſubſtituting this Value in place of the Triangle MGg in $\frac{2as+2bs}{bq} \times$ MGg, we ſhall have the Sector GMm = $\frac{2a+2b}{b}$ MGg + $\frac{\overline{a+b}\times sr}{aab}$ KGg; but by the Property of the Circle, GM × MI (sr) = BM × MN = (ſuppoſing KN = c) $\overline{cc-aa}$, which is an invariable Quantity, and is always the ſame in whatſoever Point of the Curve the deſcribing Point M be found; whence GMm + MGg or mGg, that is, the Trapezium $GMmg = \frac{2a+3b}{b} MGg + \frac{\overline{a+b}\times\overline{cc-aa}}{aab} KGg$. Now becauſe $GMmg$ is the Fluxion of the Cycloidal Space MGBA and MGg, that of the Circular Space MGB (comprehended between the Right-lines MB, MG, and the Arch BG) and KGg, that of the Sector KBG; it is manifeſt that the Cycloidal Space MGBA is $= \frac{2a+3b}{b} MGB + \frac{\overline{a+b}\times\overline{cc-aa}}{aab} \times KGB$. *Q. E. I.*

LEMMA II.

The ſame Things being ſuppoſed, if on the Centre K, *with the Radius* KA, *the Semi-circle* AEV *be deſcribed; and if on the Centre* O, *with any Radius between* OV *and* OA, *the Arch* EM *be deſcrib'd, and the Radius* KSE *be drawn; I ſay, the Arch* EM : *Arch* SN : : OE : OB.

Suppoſe the moveable Circle BSN to come into the Poſition BGN, then the Point A which deſcribes the Curve will be in M. Connect the Centres of the generating Circles with the Line OK, which will paſs through the Point of Contact G; then 'tis evident that the Triangle MOK and EOK are equal and ſimilar, becauſe the Sides of one are equal to the reſpective Sides of the other; therefore the Angles MKO, EOK, are equal, and the Arches that meaſure thoſe Angles, *viz.* GN, BS, and their Complements to two Right-angles BG, SN, are alſo equal. And becauſe the Angles MOK and EOK are equal, therefore the Angle MOE is = Angle GOB, and Arch EM : Arch GB : : OE, the Radius of that : OB the Radius of this. But it has been demonſtrated that the inferior Arch GB = ſuperior Arch GB is = SN; therefore the Arch EM : Arch SN : : OE : BB. *Q. E. D.*

CONSECTARY.

If the Radius OB be ſuppoſed infinite, then 'tis evident that the Right-lines OB and OE will be Parallels, and the Concentrick Arches VD, BN, and EM, will degenerate into Right-lines VT, BX, and EH, perpendicular to the Axis VA, and conſequently the Right-line EH will be = SN, becauſe OB and OE being infinite, are equal. Whence the Arch EM : EH : : OE : OB.

SCHOLIUM.

The Semi-cycloid AHT, into which the other Semi-cycloid AMD degenerates, when the Radius OB is infinite, is the ſame with that generated by the Revolution of the Semi-circle BSN on the Right-line BX, the deſcribing Point A being in the Diameter BN produc'd.

PROP. XIV.

The ſame Things being ſuppoſed, let it be requir'd to inveſtigate the Area of the Cycloidal Space AEM, *comprehended under the Arches* AE, EM, *and the Portion of the Cycloid* AM.

Imagine another Concentrick Arch ME infinitely near to the Arch EM, and *eh* parallel and infinitely near to EH, and the Lines EF and EP perpendicular to the Arch ME and the Right-line EH (produced if need be); then are the Angles FE*e*, OEK, equal, becauſe each added to the Angle KEF makes a Right-angle, and the Angle PE*e* is = Complement of OKE to two Right-angles, becauſe PE*e* + *e*EK + KER is = to two Right-angles = KER + EKR + KER; therefore the Sine of the Angle FE*e* is to the Sine of the Angle PE*e*, as the Sine of the Angle OEK is to the Sine of the Angle OKE: That is,

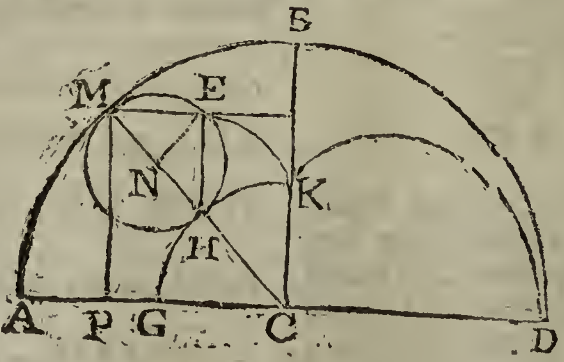
$$Fe : Pe : : OK : OE;$$

And by the Corol. of the preceding Lem. } EM : EH : : OE : OB;

Therefore $Fe \times EM : Pe \times EH : : OK : OB$.

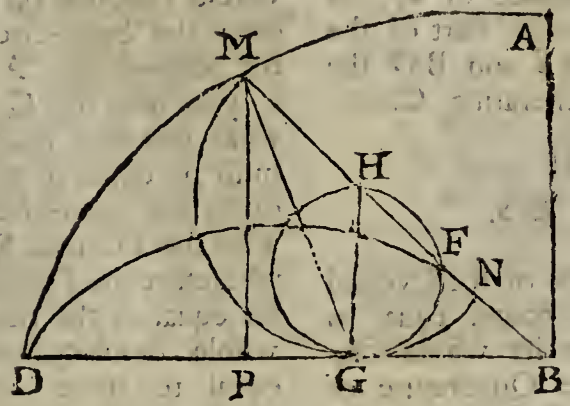
And becauſe the infinitely little Spaces EM*me*, EH*he*, are equal to the Products or Rectangles $Fe \times EM$, $Pe \times EH$ reſpectively, and the ſaid Rectangles are always in the ſame Proportion to one another, that is, the Space EM*me* is always to the correſponding Space EH*he*, as OK is to OB; 'tis plain, that the Sum of all the EM*me* is to the Sum of all the EH*he*, that is, the Space AME is to the Space AEH, as OK is to OB.

I ſhall only add further, as to this Figure of the Cycloid; that, if a Cauſtick Curve, as AFK, were to be drawn to a Semi-circle, as AMD, whoſe Diameter is AD, and its Centre C: And



when the Rays of Incidence, as PM, are ſuppoſed to be perpendicular to the Diameter AD; then the Cauſtick AFK will be a Semi-cycloid; which will be deſcrib'd by the Revolution of the little Circle MFH on the Periphery, or the Baſe KHG. For the Circle MFH is deſcrib'd on half MC, as on a Diameter; and the Angle CMF is equal to CMP, which is equal to HCK: And conſequently the Angle HNF is equal to twice HCK. Therefore the Arch HF is equal to the Arch HK; and the Curve KFA muſt be a Semi-cycloid, whoſe Beginning is in K, and its Vertex in A.

Let the Vulgar Semi-cycloid AMD be given, and deſcribed by the Revolution of the Semi-circle NGM on the Right Line BD: And let the Rays of Incidence PM, be parallel to the Axis AB: 'Tis required to draw a Cauſtick by Reflexion to the ſaid Semi-cycloid AMD.



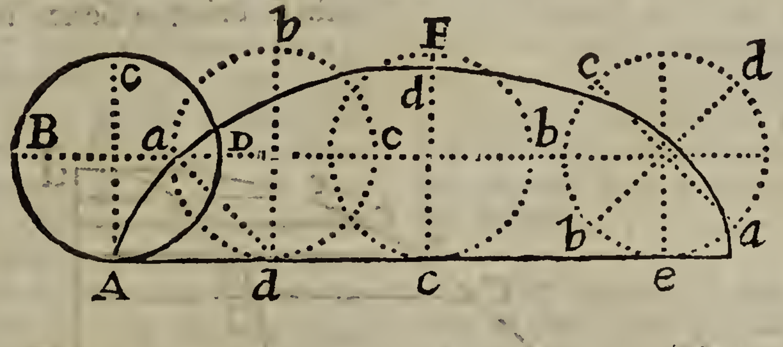
Becauſe MG is $=\frac{1}{2}$ the Ray of the *Evoluta*, and GP perpendicular to PM: Therefore MF $=\frac{1}{2}A = PM$. Whence if GF be drawn perpendicular to the reflected Ray ME, the Point F will be in the Curve required.

If the Rays HM, HG, be drawn from H, the Center of the generating Circle, to the deſcribing Point M, and the Point of Contact G; 'tis evident that HG will be perpendicular to BD; and that the Angle GMH = MGHGMP; whence it appears, that the reflected Ray MF paſſes through the Centre H. Now the Circle whoſe Diameter is GH paſſes alſo through the Point F; becauſe GFH is a Right Angle: And therefore the Arches GN, and half GF, which meaſure the Angle GHN, are proportionable to the Diameters MN, GH, of their reſpective Circles: And conſequently the Arch GF = Arch GN = GB. Whence it is manifeſt, that the Cauſtick DFB is a Cycloid, and deſcrib'd by the Revolution of the Circle GFH on the Right Line BD. *Q. E. D.*

COROLLARY.

The Space DABFD is equal to thrice the Area of the Circle GFH: For the Semi-circle MGN is equal to twice the Area of the Circle GFH: Wherefore the Cycloidal Space AMDB is equal to 6 times the Area of the Circle GFH; and the Cycloidal Space BFD is equal to thrice the Area of the Circle GFH; and conſequently the Space DABFD is equal to thrice the Area of the Circle GFH; and the Curve DFB divides the Space AMBD into two equal Parts.

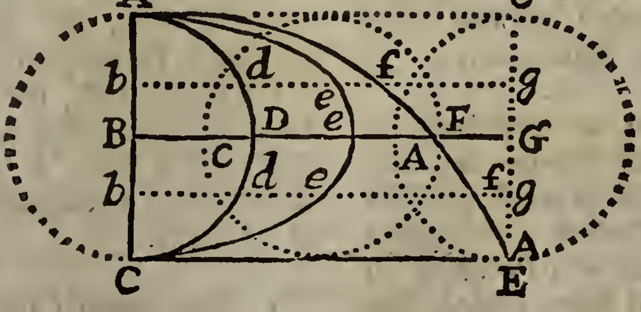
If on a right Line, as AE, a Wheel or Circle be imagined to make one entire Revolution, or to move till the Point A come to touch the Line again at E; the Circle will deſcribe the Line AE, equal to its Periphery; and the Point A will deſcribe a Curve Line A*a*FE, which is called a Cycloid or Trochoid, and the Space contained within this Curve and the Subtenſe AE is called the Cycloidal Space.



From the Conſideration of which Geneſis, 'tis very plain, that the Point *a* which deſcribes the Curve, will every where be diſtant from *d* the Point of Contact, by ſuch a Part of the Circle as is the Diſtance of that Point of Contact from A, the Beginning of the Line. Thus when A*d* is a Fourth Part of the whole Subtenſe, then will *da* be a Quadrant of the Generating Circle; when A*c* is half that Line, then the Arc *ac* is a Semicircle, *&c.* So likewiſe at the other End, when the Arc *ac* is an Octant, *e*E will be an Eighth Part of the Line AE.

Prop.

Any Semi-ordinate in the Cycloid (or the Right Line BF, *or* bf) *is equal to its correſponding Right Sine in the Generating Circle, as* BD, bd) *together with the Arch of that Sine,* AD, *or* ad.



This is proved from the Conſideration of the Manner of the Generation of the Cycloid above delivered: For ſince the Right Line CE is equal to the Semi-circular Arc ADC, the Right Line

DF muſt be equal to the Quadrantal Arc AD: for the ſeveral Arcs of the moving Circle do every where generate Right Lines equal to themſelves; wherefore any Semi-ordinate drawn to the Curve of the Cycloid muſt be compounded of *df*, or DF, *viz.* a Right Line equal to the Part of the Arc that hath revolved, and of *bd* and BD the Right Sine of that Arc in the Generating Circle. *Q. E. D.*

COROLLARIES.

1. Hence 'tis plain, that by means of the Cycloid a Right Line may moſt eaſily be found equal to any given Arc of a Circle, or to its whole Circumference; and conſequently the Quadrature of the Circle may Geometrically be had, if this Cycloid be a true Geometrical Curve, as indeed it is not.

2. If you ſuppoſe *de*, D*e*, and *de* to be every where drawn equal to the Right Lines *bd*, BD, and *bd*; the Curve Line connecting their Extremities will be an Ellipſis [*by a Propoſition which you will find under the Word* Elliptical Space) for the whole Aggregate of all theſe Right Lines, or the Elliptical Space will be double of the Semi-circular one; *i. e.* as B*e* is to BB, and conſequently the Curvilineal Space A*e*CDA will be equal to the Semi-circular Space ADCA.

3. DF (*i. e.* D*e* + *e*F) = Quadrant DA, wherefore ſince the whole BG = to a Semi-circle, the Remainder BD + FG muſt alſo be equal to a Quadrant; but BD = D*e* (by *Cor.* 2.) wherefore *e*F will be equal to FG; and the ſame Way of arguing will always prove *ef* above, equal to *fg* below, wherefore all the Indiviſibles in each being equal, the Space *ee*A*f*F will be equal to the Space FGE. Hence,

4. *'Tis plain, that the Cycloidal Space is always triple of the Generating Circle.*

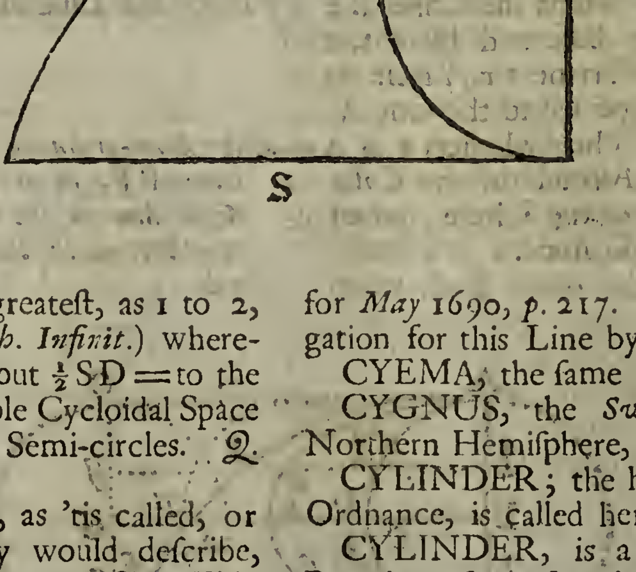
For the Rectangle BCEG is equal to the whole Circle (becauſe on one Side is the Radius, and the other the Semi-circumference) that is, is equal to the Semi-ellipſis A*e*CDA; wherefore, if out of it you take the Quadrant of the Ellipſis B*ee*CB, what remains, which is the *Trapezium* C*e*GEC, muſt be equal to the other Quadrant of the Ellipſis, or to the Semi-circle. But it was proved in *Cor.* 3. That the Trilinear Space FGE was equal to *ee*A*f*F; wherefore the Trilinear Figure A*f*FECA muſt alſo be equal to the Semi-circle; and conſequently the whole Semi-cycloidal Space AFECA muſt be equal to three Semi-circles, and therefore the whole Cycloidal Space triple of the Generating Circle. *Q. E. D.*

Otherwiſe thus:

The Rectangle AE is equal to two Circles, and the Semi-ellipſis A*e*CA to one, wherefore the remaining Space A*e*CEC muſt alſo be equal to another ſuch Circle, and its lower half to a Semi-circle, as well as its upper one; but in the lower half, the Figure FGE = to the Figure *ee*A*f*F in the upper half; wherefore counterchange them, and the Space CEAFA muſt be equal to a Semi-circle, and conſequently the Semi-cycloidal Space equal to three Semi-circles. *Q. E. D.*

The following Demonſtration of the ſame Propoſition I had from Mr. *Humphry Ditton*, who is very skilful in Things of this Nature: 'Tis very ſhort and plain, and depends on the Arithmetick of Infinites. Thus,

The Figure is a Semi-cycloid, where the Arcs *do*, *do*, *d*O, *&c.* are ſuppoſed to be in Arithmetical Proportions, and conſequently ſo will the Lines *co*, *co*, C*o*, *&c.* which from the Nature of the Cycloid are all equal ſeverally to thoſe Arcs: Now theſe being a Series of Arithmetical Proportions, will be to as many equal to the greateſt, as 1 to 2, (by *Prop.* 2. of Dr. *Wallis*'s *Arith. Infinit.*) wherefore the Space C*d*OS = $\frac{1}{2}$SD, but $\frac{1}{2}$SD = to the whole Circle, wherefore the whole Cycloidal Space CDS muſt be equal to three Semi-circles. *Q. E. D.*



The *Linea Celerrimi Deſcenſus*, as 'tis called, or the Curve which any heavy Body would deſcribe, ſuppoſing it to deſcend with the greateſt poſſible Swiftneſs, is the *Arc of the Cycloid.* This *John Bernoulli*, I think, firſt propoſed, as a Problem to be diſcovered, and it hath often been ſolved, but very briefly and eaſily by Mr *John Craig*, in *Philoſ. Tranſact.* N. 268. In the *Acta Eruditorum Lipſ.* for *May* 1690, *p.* 217. there is a Method of Inveſtigation for this Line by *James Bernoulli.*

CYEMA, the ſame with *Embryo.*

CYGNUS, the *Swan*, a Conſtellation in the Northern Hemiſphere, conſiſting of 35 Stars.

CYLINDER; the hollow within every Piece of Ordnance, is called her *Concave Cylinder.*

CYLINDER, is a Solid Body, made by the Rotation of a rectangled Parallelogram about one of its Sides.

1. Since every Cylinder hath a Circle for its Baſe, it will be very proper to denote its Baſe thus, $\frac{1}{4}rdd$ (the Reaſon of which you have under *Circle*:) and

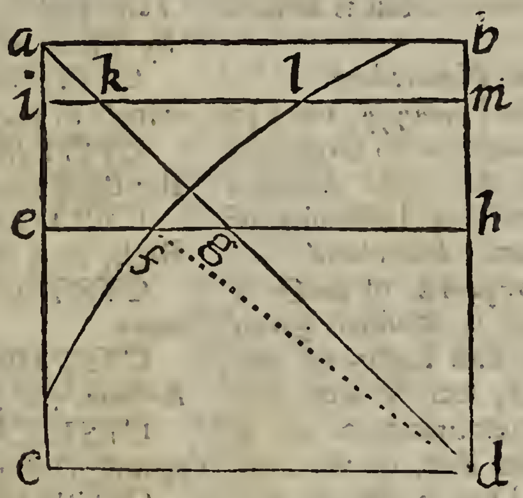
then, if the Altitude of the Cylinder be called *h*, (*i. e.* its Height) the Solidity of the Cylinder will be expreſſed thus, $\frac{1}{4}$ *r d d h.*

2. If therefore the Altitudes of any two Cylinders be equal to the Diameters of their Baſes, ſuch Cylinders muſt be to one another, as the Cubes of their Diameters or Altitudes; for here, *h*, the Height being the ſame with *d*, the Diameters of the Circle of the Baſe: If in one Cylinder it be called *d*, and in the other D, the Solidity of the former will be $\frac{1}{4}$ *r d d d*, and of the latter $\frac{1}{4}$ *r* D D D; but doubtleſs $\frac{1}{4}$ *r* being a common Efficient or Multiplier: $\frac{1}{4}$ *r d d d*: $\frac{1}{4}$ *r* D D D : : *d d d*: D D D, that is, the Cylinders are as the Cubes of their Diameters. *Q. E. D.*

3. Every Cylinder is triple of a Cone of the ſame Baſe and Height; which ſee proved in *Proportion of Solids.*

4. Every Cylinder is to a Sphere inſcribed, and of the ſame Baſe and Height as 3 to 2.

If the Square and Quadrant with the Diagonal *a d*, be ſuppoſed to revolve round the Axis *b d*, the Square will generate a Cylinder, the Quadrant an Hemiſphere, and the Triangle *a d b* a Cone all of the ſame Baſe and Height.



And ſince Circles are as the Squares of their Diameters, and that the Square of *e h* (= □ of *d f*) = □ *g h* (= □ *h d*) + □ *h f*, by 47. *e.* 1; therefore the Circle deſcribed by *e h*, or its = *c d*, muſt be equal to two Circles deſcribed by *g h*, and by *h f*: Take away then the common Circle, deſcribed by *h f* from both, and there will remain the Circle deſcribed by *g h* = to the Ring deſcribed by *e f*. And thus it will always be, that (*v. gr.*) the Circle deſcribed by *k m*, will be equal to the Annulus or Ring made by the Motion of *i l*; wherefore all the Rings made by the Revolution of *e f*, *i l*, *&c.* muſt be equal to all the Circles deſcrib'd by the Motion of *g h*, *m k*, *&c.* that is, all the Solid, compoſed of the Rings made by the Motion of the Parts of the Trilinear Figure *c f l b a.* ſhall be equal to all the Circles generated by the Elements of the Triangle *a d b*: Wherefore ſince the Cone is $\frac{1}{2}$ of the Cylinder on the ſame Baſe and Height, and that the Solid made by the Trilinear *c f l b a*, is alſo another third Part, as being equal to the Cone; the Hemiſphere muſt be $\frac{2}{3}$ of the Cylinder, and conſequently, if the Baſe and Altitude of the Cylinder were equal to the Diameter of the Sphere, the whole Sphere would be $\frac{2}{3}$ of the Cylinder.

Cor. 1. From hence we have the Dimenſions of the Sphere and Cylinder, both as to Solidity and Surface; for let *d* be the Diameter of the Sphere and Cylinder, and *r d* the Circumference of the Baſe of the Cylinder; then will the whole Baſe be $\frac{1}{4}$ *r d d*, (which alſo is the Area of a great Circle of the Sphere;(and this Baſe multiply'd by *d* the Altitude, gives $\frac{1}{4}$ *r d d d* for the Solidity of the Cylinder; and therefore, by this *Prop.* $\frac{2}{3}$ of that gives the Sphere (*i. e.*) $\frac{1}{6}$ *r d d d* = Solidity of the Sphere; and that laſt Quantity divided by $\frac{1}{6}$ *d* (one Sixth of the Diameter) gives *r d d* the Surface of the Sphere.

2. Which Surface *r d d* is manifeſtly Quadruple of $\frac{1}{4}$ *r d d*, the Area of a great Circle of the Sphere, or the Baſe of the Cylinder.

3. Wherefore, by multiplying *r d* (= to the Periphery of the Baſe of the Cylinder by *d* the Altitude) you have *r d d* for the Curve Surface of the Cylinder; which therefore is equal (taken without its proper Baſes) to the Surface of the Sphere; and conſequently, adding in the Baſes (each of which is $\frac{1}{4}$ *r d d*) the whole Surface of the Cylinder, Baſes and all, will be 1 $\frac{1}{2}$ *r d d*, that is, to the Surface of the Sphere as 3 to 2.

4. The Square of the Diameter (*d d*:) To the Area of the Circle $\frac{1}{4}$ *r d d.*: Is as *d* : $\frac{1}{4}$ *r d*, for *d d* : $\frac{1}{4}$ *d d* : : *d* : $\frac{1}{4}$ *r d*) that is, as the Diameter to $\frac{1}{4}$ of the Circumference.

5. Becauſe the Solidity of the Cylinder is $\frac{1}{4}$ *r d d d*, therefore the Cone of the ſame Baſe and Height will be $\frac{1}{12}$ *r d d d*, which is plainly the Difference between $\frac{1}{4}$ *r d d d*, and $\frac{1}{6}$ *r d d d*, the Solidity of the Cylinder and Sphere; ſo that the Cone is equal to the Exceſs of the Cylinder above the Sphere; and the Cone, Sphere and Cylinder are as 3, 2 and 1; ſo that the Sphere is two Thirds of the Cylinder. See this laſt proved much ſhorter under the Word Indiviſibles.

If you conſider a Cylinder, as compoſed of an infinite Number of Cylindrical Surfaces decreaſing (as the Circles of the Baſe on which they ſtand) in Arithmetical Progreſſion; if you call the outermoſt or greateſt Surface *S*, and the Radius of the Baſe *r*, the Solidity of the Cylinder will be expreſſed by $\frac{1}{2}$ *r* S: And it will be diverting to meaſure a Cylinder by both of theſe different Ways, in order to ſee how nearly they will agree.

CYLINCROID, a ſolid Figure with elliptical Baſes parallel and alike ſituated.

CYLINDRUS, is a Plaiſter made oblong, which ſome Phyſicians call *Magdaleo. Blanchard.*

CYLLOSIS: See *Cyllum.*

CYLLUM, [of κυλλὸς, *Gr. Lame.*] ſignifies a Leg put out of Joint outwardly; alſo one Lame and Crooked.

CYMA (κῦμα, *Gr. a Wave.*] among the Botaniſts ſignifies the Top of any Plant or Herb.

CYMATIUM [κυμάτιον, *Gr.* a little Wane] a Member of Architecture, whereof one Half is Convex, and the other Concave: There are two Sorts of *Cymatiums, viz.* one called *Doucires* or *Right Gula*, the moſt advanced Part of which is Concave; and the other *Talon* or *Reverſed Gula*, which hath its moſt advanced Part Convex, but is hollow below, as the firſt is above.

CYMBIFORME *Os*: See *Os Naviculare.*

CYNANCHE and *Gycnanche* [κυνάγχη, *Gr.*] ſo called becauſe it is frequently incident to Dogs and Wolves, is an Inflammation of the inner Muſcles of the *Larynx*, accompanied with a Difficulty of Breathing, and a continual Fever. *Blanchard.*

CYNANTHROPIA [κυνανθρωπὶα, of κυνὸς a Dog, and ανθρωπος, *Gr.* a Man] is Madneſs given by a Dog, wherein the Patient flies Light, or any thing that is bright and ſplendid; fears Water, and trembles at the Sight and Remembrance of it: It proceeds uſually from a poiſonous Bite, or the like, of ſome mad Creature, as a Dog, a Wolf, *&c. Blanchard.*

CYNICUS *Spaſmus*, the Convulſion of the Muſcles of the Mouth, by which the Face is ſo diſtorted, that it reſembles the Countenance of a grinning Dog. *L.*

CYNODES *Orexis* [of κυνοειδὴς, of κυνὸς a Dog, and ὄρεξις, *Gr.* an Appetite] is a Canine Appetite, or an extreme Hunger join'd with Vomiting or a Looſeneſs: It ariſes from a too much or a too acid Ferment in the Stomach. *Blanchard.*

CYNODESMUS [κυνοδέσμιον, *Gr.*] is the Band which ties the little Skin of the Yard to the Glands.

CYNODENTES [of κυνόδοντες, of κυνὸς and ὀδοὺς, *Gr.* a Tooth.] are thoſe Teeth between the Axle-Teeth and the Grinders, called *Canini, Columellares*, and *Oculares*; Eye-Teeth, as we ſay. *Blanchard.*

CYNOREXIS. See *Cynodes Orexis.*

CYNOSURA [κυνοσουρὰ, of κυνὸς and οὐρὰ, *Gr.* a Tooth.] a Conſtellation conſiſting of ſeven Stars; otherwiſe called *Urſa Minor*, or the *Little Bear*, in the Tail of which is the *Polar Star.*

CYPHER, or *Nought*, thus noted, (o) which put before a Figure, ſignifies nothing (except in Decimal Arithmetick, where it augments, being put before, in the ſame Proportion as when put after Integers) but after a Figure it increaſes it by Ten, and ſo onwards in Decuple Proportion, or by Tens, *ad Infinitum.*

CYPHOMA, or *Cyphoſis* [κύφωσις, *Gr.*] Crookedneſs of the Back.

CYPHOSIS, is the bending of the Vertebres of the Back toward the Back Parts.

CYRTOMA [κύρτωμα, *Gr.*] is a Bunch on the Back, or a Tumor in any other Part.

CYRTOSIS [κύρτωσις, *Gr.*] the ſame with *Cyrtoma.*

CYSTAROS [of κύσαρος, *Gr.*] is the Gut call'd *Rectum*, the lowermoſt of all; alſo the Fundament.

CYSTICA [κυστικὰ, *Gr.*] are Medicines uſed againſt Diſtempers in the Bladder.

CYSTICÆ *Gemellæ*, a very ſmall Branch of the *Celiack* Artery diſperſed through the Gall-Bladder. *L.*

CYSTICUS *Meatus* [in *Anatomy*] a Bilary Duct about the Bigneſs of a Gooſe Quill, join'd to the *Meaticus Hepaticus*, at about two Inches diſtant from the Gall Bladder, the two together from the *Ductus Communis. L.*

CYSTIS [κύστις] is the Bladder that holds the Urine or the Gall.

CYSTIS *Choledochus*, the ſame with *Folliculus Fellis:*

CYSTOTOMY [κυστοτομία, of κύστις and τομὴ, *Gr.* a Cutting.] the Cutting of a Bladder.

DACRYODES, [of δάκρυον a Tear, and εἶδος, *Gr.* Shape] are Ulcers which continually ſend forth Matter. *Blanchard.*

DACTYLE, [δακτυλὴ, *Gr.*] is the Foot of a *Latin* Verſe, conſiſting of three Syllables, whereof the firſt is long, and the other two are ſhort; as *Carmina.*

DACTYLICK, [of δάκτυλος, *Gr.*] of, or appertaining to a Dactyle.

DACTYLONOMY, [of δάκτυλος a Finger, and νομος, *Gr.* a Law, Rule, *&c.*] is the Art of Numbring on the Fingers.

DADO, a Term in Architecture, by ſome Writers uſed for the *Dye*, which is the Part in the Middle of the Pedeſtal of a Column between its Baſe and Cornice: 'Tis of a Cubick Form, whence the Name of *Dye* is given to it.

DAKIR, by the Statute of 23 *H.* 3. *de compoſitione Ponderum, &c.* was a Number of Ten *Hides*, as a *Laſt* was of 20 *Dakirs:* But ſince, by 1 *Jac.* 33. a *Laſt* of *Hides* is 12 Dozen.

DAILY MOTION of a Planet: See *Diurnal Motion.*

DAMAGE, is generally taken to ſignify any Hurt or Hindrance that a Man taketh in his Eſtate; but in Common Law it is Part of that the Jurors be to enquire of, paſſing for the Plaintiff or Defendant in a Civil Action, be it Perſonal or Real: For after Verdict given of the principal Cauſe, they are likewiſe asked their Conſciences (touching Coſts, which are the Charges of the Suit, called of the *Civilians, Expenſæ Litis*) and Damages, which contain the Hindrances that the Plaintiff or Demandant hath ſuffered, by means of the Wrong done to him by the Defendant or Tenant.

This Word Damage (in Law) has two ſeveral Significations, the one properly and generally, the other ſtrictly and relatively: Properly, as it is in Caſes where Damages are founded upon the Statute of 2 *H.* 4. *Cap.* 1. and 8 *H.* 6. *Cap.* 9. where Coſts are included within this Word Damages; for Damage, in its proper Signification, is ſaid *à Demendo*, when by Diminution a thing becomes worſe; and in this Senſe, Coſts of Suits are Damages to the Plaintiff, for by it his Subſtance is diminiſhed. But when the Plaintiff declares the Wrong done him to the Damage of ſuch a Sum, this is to be taken relatively, for the Wrong which is paſſed before the Writ brought, and are aſſeſſed by Reaſon of the Treſpaſs aforeſaid, and cannot extend to the Coſts of Suit, which are future, and of another Nature.

DAMAGE CLEERE; *Damna Clericorum* is now aſſeſs'd by the Tenth Part in the *Common Pleas*, and the Twentieth Part in the *King's Bench* and *Exchequer*, of all Damages (exceeding five Marks) recovered either by Verdict, Confeſſion, or Judgment of the Court in all Actions upon the Caſe, Covenant, Treſpaſs, Battery, Falſe Impriſonment, Dower, and all others wherein Damages are uncertain, which the Plaintiff was to pay to the Prothonotary, or chief Officer of that Court wherein they are recovered, before he ſhall have Execution for them. This was originally only a Gratuity given to the Prothonotaries, and their Clerks, for drawing ſpecial Writs and Pleadings, which afterwards grew to a Certainty; but now this is taken away by 17 *Car.* 2. *c.* 6. for that it was an unneceſſary Charge and Burden upon the King's Subjects.

DAMAGE *Feaſant*, in Common Law, is when Stranger's Beaſts are in another Man's Ground without Licence of the Tenant of the Ground, and there do feed, tread, and otherwiſe ſpoil the Corn, Graſs, Goods, and ſuch like; in which Caſe the Tenant, whom they damage, may therefore take, diſtrain, and impound them, as well in the Night as in the Day: But in other Caſes, as for Rents and Services, and ſuch like, none may diſtrain in the Night.

DAMNATA *Terra*, is the ſame with the *Caput Mortuum* of the Chymiſts, being only the Earth or Maſs that remains in the Retort, *&c.* after all the other Principles are forced out by the Fire. *L.*

DAMNUM, did formerly ſignify the Bounds or Limits of a Man's private Property or Juriſdiction; as is plain by *Bracton, lib.* 2. *de Coron. c.* 37. And perhaps our Word *Dam*, for a Boundary or Confinement came from hence. *L.*

DAMPS, in Mines, are noxious Exhalations, which in ſome Mines have proved very ſuffocating, and otherwiſe fatal to the Workmen. They reckon four Sorts of Damps.

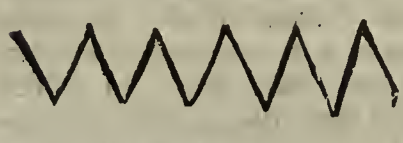
The Firſt is the moſt ordinary; they know when 'tis coming, by the Flame of their Candles becoming orbicular, and by the Flames leſſening by degrees, 'till at laſt it quite go out; as alſo by their Shortneſs and Difficulty of Breathing. Thoſe that eſcape Swooning, ſeldom ſuffer any great Harm by it; but ſuch as ſwoon away, tho' they miſs of downright Suffocation, are on their firſt Recovery tormented with very violent Convulſions. Their Way of Cure is to lay the Perſon down on the Earth in a prone Poſture, with a Hole dug in the Ground under his Mouth; if this fail, they fill him full of good Ale; and if that won't do, they conclude him deſperate.

2. The Peaſe-Bloom Damp, which is ſo called from its Smell; this Damp they ſay always comes in the Summer Time, and it hath not been known to be mortal. The Miners in the *Peake* of *Derby* fancy it ariſes there from the Multitude of Red Trefoil Flowers, called by them Honey-Suckles, with which the Lime-ſtone Meadows of the *Peake* do much abound. Perhaps the Smell of this gives timely Notice to get out of the Way.

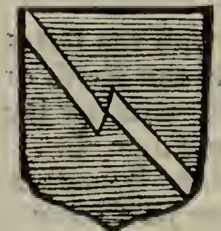
3. The Third is the moſt peſtilential and the moſt ſtrange of all, if what they ſay of it be true: They who pretend to have ſeen it, (for 'tis viſible they ſay) do thus deſcribe it: In the higheſt Part of the Roof of thoſe Paſſages in a Mine which branch out from the main Grove, they ſee a round Thing hanging about as big as a Foot-ball, covered with a Skin of the Thickneſs and Colour of a Cobweb: If this Bag by a Splinter, or any other Accident, become broken, the Damp immediately flies out, and ſuffocates all the Company: The Workmen, by Help of a Stick and a long Rope, have a Way of breaking this at a Diſtance; and when they have done this, they purify the Place well with Fire: And they will have it, that it gathers from the Steam of their Bodies and Candles, aſcends up into the higheſt Part of the Vault, and there condenſes, and in Time hath a Film grows over it, and then corrupts and becomes peſtilential.

4. The Fourth is the Fulminating or Fire-Damp, whoſe Vapour being touch'd by the Flame of the Candles, preſently takes fire, and hath all the Effects of Lightning or fired Gunpowder. Theſe are found frequently in the Coal-Mines, and ſometimes, tho' rarely, in the Lead ones.

DANCETTE, a Term in Heraldry, when the Out-line of any Bordure or Ordinary is of this Shape, that is, indented in and out very largely, in which only it differs from Indented.



DANCHE, [in *Heraldry*] indented, or the ſame as Dancette.



There is a bearing of a Bend called double Dancette; thus, he beareth *Azure*, a Bend double *Dancette Argent*.

DANE-GELT, or *Geld*, was a Tribute which the *Danes*, on their frequent Incurſions, impoſed upon the *Engliſh* as the Arbitrary Terms of Peace and Departure. It was firſt impoſed as a continual yearly Tax upon the whole Nation under K. *Ethelred*, *A. D.* 991. *Ælfred* and *Ingulph* report, that King *Edward* the Confeſſor remitted and abrogated this Tax: But *William* the Conqueror, tho' he would not re-induce the Annual Payment, yet he ordered the raiſing of it, as often as the Neceſſities of Invaſion or Expedition did require: And it was ſeverely exacted and augmented by *William Rufus*. In the Reign of *Henry* I. it was computed amongſt the King's ſtanding Revenues: But King *Stephen*, upon his Coronation-Day, promiſed that *Dane-gelt* ſhould be for ever remitted; from which Time ſome date the Expiration of this Tax. But it ſeems rather to have continued upon extraordinary Occaſions, 'till it was abrogated by Time; or ſwallowed in Tillage and Parliamentary Impoſitions. The Laws of *Edward* the Confeſſor, *c.* 11. rate this Tax at 12*d.* on every Hide: *Henry Hunt* computes it at 2*s.* on each Hide; and *John Brampton* at 3*d.* on a *Bovate* or *Oxgang*. And no doubt it varied according to the different Exigencies on which it was levied. Dr. *Kennet*'s *Gloſſary.*

DANGER, *Dangerium*, in ſome Places called *Lief-Silver* and *Lef-Silver*, was formerly a Payment of Money made by the Foreſt Tenants to their Lords, that they might have Leave to plow and ſow in Time of *Pannage* or Maſt-feeding.

DANTELE, [in *Heraldry*] the ſame as Danche, or rather Dancette, *viz.* a large open Indenture.

DARAPTI, [in *Logick*] one of the Moods or Syllogiſms.

DARKENED *Room*: See *Obſcura Camera.*

DARK *Tent*, is the Term which ſome Writers give to a Box made almoſt like a Desk with Optick Glaſſes, to take the Proſpect of any Building, Fortification, Landskip, *&c.* This is a portable *Camera Obſcura*, or *Darkened Room*: See the Deſcription under *Obſcura Camera.*

DARREINE, in the Common Law, ſeems to be a Corruption from the French *Dernier*, *i. e. Laſt*; for 'tis now uſed in that Senſe, in

DARREINE, *Continuance*: And,

DARREINE, *Preſentment.*

DARSIS, [δάρσις, *Gr.*] is an Excoriation of the Skin. *Blanchard.*

DARTUS, [δαρτὸς of δέρω, *Gr.* to excoriate] is the ſecond or inner *Tunick* of the common Coats, which immediately cover the Teſticles; it ariſes from the *Membrana Carnoſa*, and ſeems to be Muſcular from its Power of conſtricting and wrinkling itſelf up; it adheres to the *Tunica Vaginalis* that lies under it by many Membranous Fibres. *Ruyſch* ſaith, that it hath the *Membrana* alſo under the *Carnoſa Adipoſa.*

DASSYMA, is a ſuperficial Inequality of the inner Part of the Eye-lids, accompanied with a Redneſs. *Blanchard.*

DATA, is the Term in Mathematicks for ſuch Things or Quantities as are ſuppoſed to be given or known, in order to find out thereby other Things or Quantities which are unknown or ſought for; and *Euclid* uſes the Word *Data* (of which he hath a particular Tract) for ſuch Spaces, Lines, and Angles, as are given in Magnitude, or to which we can aſſign others equal: See *Given.*

DATE [*Datus*, *L.*] An Addition in Writings, Letters, Bonds, Bills, and other Inſtruments, expreſſing the Day of the Month and Year when the Letter or Act was paſs'd or ſign'd.

DATISI [in *Logick*] one of the Moods of Syllogiſms.

DATIVE CASE, is the third Caſe in the Declenſion of Nouns, Pronouns, *&c.* and is ſo called, becauſe 'tis uſually governed by a Verb, which implies ſomething to be *given* to ſome Perſon, and the Thing is put in the Accuſative Caſe, and the Perſon in the *Dative.*

DATIVE *Tutelage*, is a Term in the Civil Law, for ſuch a Tutelage of a Minor as is appointed by the Magiſtrate either *ex Officio*, or by Petition, when a Guardian by *Will*, or by *Law*, is not already provided.

DAVIS's *Quadrant*, is the common Back-Quadrant: See its Deſcription under the Word *Back-ſtaff.*

DAVIT, a Piece of Timber in a Ship, having a Notch at one End; in which, by a Strap, hangs a Block called the *Fiſh-Block*: And the Uſe of this Block is to hale up the Fluke of the Anchor, and to faſten it at the Ship's *Bow* or *Loof.* This *Davit* is ſhiftable from one Side of the Ship to the other, as Occaſion ſerves.

There is a ſmall *Davit* in the Ship's Boat, which is ſet over her Head with a Shiver, in which is brought the Buoy Rope, wherewith to weigh the Anchor; and it is made faſt to the Carlings in the Boat's Row.

DAY, in our Common Law, is ſometimes uſed for the Day of Appearance in Court, either Originally or on Aſſignation; and ſometimes for the Return of Writs.

A Day is a Space of time wherein the Sun by his apparent Motion, either deſcribes a certain Part of a Circle, or makes an entire Revolution, and is either Natural or Artificial,

A Natural Day is the Duration of an entire apparent Revolution of the Sun about the Earth,

The Artificial is that Part of the Natural Day, in which the Sun continues above the Horizon, and is oppoſite to the Night, being that Part of the Time which the Sun is under the Horizon, but the Natural Day contains both.

The Natural Day is either Aſtronomical or Civil; the Aſtronomical Day is the Space of Time that flows between the Sun's leaving a given Meridian, and the next Return to the ſame; that is, the Space of Time wherein a Revolution of the whole Cœleſtial Equator is performed, and of that Part of it beſides which it anſwers to 59 Minutes, 8 Seconds of the Ecliptic, the Sun's mean Motion in one Day; for when the Degree of the Equator the Sun was in, when laſt at the Meridian, together with the Degree of the Ecliptick oppoſite to it, are again arriv'd at the Meridian, the Sun has not reach'd it; for while the Earth by its Motion round its Axis, has made the Diurnal Phœnomena of the Revolution of the Equator, the Sun in his annual apparent Motion having moved almoſt a Degree towards the Eaſt, therefore a ſmall Portion of Time muſt be allow'd more than the Revolution of the Equator, to compleat an Aſtronomical or Natural Day; and by reaſon of the Inequality of the apparent Motion of the Sun, together with the Obliquity of the Ecliptic, which makes the Arch of the Equator anſwering to the ſeveral Degrees thereof unequal; therefore that additional Part of Time, which is every Day to be added to the Revolution of the Equator, to compleat the Time of the Sun's departing from any one Meridian till his Return to the ſame again, muſt be unequal; and from this ariſes the Inequality of Natural Days.

DAYS *in Bank*, are Days ſet down by Statute or Order of the Court, when Writs ſhall be return'd, or when the Party ſhall appear on the Service of the Writ. They ſay alſo, That if a Perſon be diſmiſſed without *Day*, he is finally diſcharged the Court.

DAYWERC *of Land*, was anciently as much as could be plowed up in one Day's Work or Journey, as the Farmers in ſome Places ſtill call it.

DAZE, is one of the *Weeds*, as they call them, which are found in our Tin Mines; 'tis a kind of glittering Stone enduring the Fire; and is of different Colours, as White, Black and Yellow. It ſeems to be a Spar.

DEADLY *Feud* [in *Law*] a Profeſſion of irreconcileable Enmity, till we are revenged by the Death of our Enemy.

DEAD-MENS-EYES, in a Ship, are a Kind of *Blocks*, having many Holes in them, but no *Shivers*; and through them the *Lanniers* go, which make faſt the Shrowds below to the Chains. Sometimes, but rarely, the Main-Stays of a Ship are ſet taught by *Dead-Mens-Eyes* and *Lanniers*. The *Crowfeet* always do *reeve* through *Dead-Mens-Eyes*.

DEAD-RECKONING, at Sea, is that Eſtimation, Judgment, or Conjecture, which the Seamen make of the Place where the Ship is, by keeping an Account of her Way by the *Log*, by knowing the Courſe they have ſteered by the Compaſs, and by rectifying all with Allowance for *Drift*, *Lee*, *Way*, &c. according to the Ship's Trim; ſo that this Reckoning is without any Obſervation of the Sun, Moon, and Stars, and is to be rectify'd as often as any Good Obſervation can be had.

DEAD-Riſing, a Term in the Ship for that Part of her which lies aft between the Keel and her Floor Timbers, and next adjoining to the Stern-Poſt under the Bread-Room in a Man of War.

DEAD-WATER, is the Eddy Water juſt behind the Stern of a Ship; and if a Ship hath a great Eddy follows her Stern, they ſay *ſhe makes much Dead Water*: This is ſo called becauſe it doth not paſs away ſo ſwiftly as the Water running by her Sides doth.

DEADS, in the Tin-Miners Language, are ſuch Parcels of common looſe Mould or Earth lying above the *Shelf*, as uſually contain the *Shoad*, which they find when they are training a *Load*. They call alſo that Part of the Shelf, which contains no Oar or Metal, but encloſeth the Load as a Wall between two Rocks, by this Name. See *Tin*.

In the *Mendip* Lead-Mines; when a Vein of Oar breaks off abruptly in an Earth, they call it a Deading-Bed; and Earth without an Oar they call Dead Earth.

DEAD *Ropes* in a Ship, are ſuch as are not running, *i. e.* which do not run in any Block.

DEAFFORESTED [in *Law-Books*] the being diſcharged from being foreſt, or freed and exempted from Foreſt Laws.

DEAN. Originally the *Decanus* was ſo called, becauſe he was an Eccleſiaſtical Magiſtrate, which had Juriſdiction and Power over Ten Canons at leaſt. He is next under the Biſhop, and ordinarily Chief of the Chapter in a Cathedral Church.

As there are Two Foundations of Cathedral Churches, the Old and the New, (the New being thoſe which *Henry* the Eighth founded on the Suppreſſion of the Abbots and Priors, and turned their Convents into Dean and Chapter;) ſo there are Two Ways of Creating theſe Deans. For thoſe of the Old Foundation, are brought to their Dignity much like a Biſhop: The Prince firſt ſending out his *Conge d'Eſlire* to the Chapter; the Chapter there chuſing, the King yielding his Royal Aſſent, and the Biſhop confirming him, and giving his Mandate to inſtall him.

Thoſe of the New Foundation are inſtalled by a ſhorter Courſe; only by the King's Letters Patent, without either Election or Confirmation.

The Word Dean is alſo apply'd to divers that are the chief of ſome peculiar Churches or Chapels; as Dean of the King's Chapel, of *Paul's*, of *Weſtminſter*, of the *Arches*, of *Battel*, of *Boking*, &c.

DEAN *Rural*, or *Urban*, call'd *Decanus Chriſtianitatis*, was formerly an Eccleſiaſtical Perſon, who had the Diſtrict of ten Churches either in the Country or City, within which he exerciſed a uſeful Juriſdiction. Theſe Rural Deans were ſometimes called *Archipresbyteri*, and at firſt were both in Order and Authority above the Archdeacons. They were elected by the Clergy, and by their Votes again depoſed; but afterwards they were appointed and remov'd at the Diſcretion of the Biſhop: And hence they were called *Decani Temporarii*, to diſtinguiſh them from the Cathedral Deans, who were called *Decani perpetui*.

DE BENE ESSE, a Term in Common Law, as when the Defendant's Depoſition or Bail is only allowed for the preſent, but after more full Examination is either to ſtand or fall.

DEBENTUR, was a Kind of Writing firſt given in the late Times of the Uſurpation to the Soldier, to ſecure the Payment of his Arrears; 'tis uſed alſo in the *Exchequer*, and in the King's Houſe *Debentures* are given uſually to the Servants, for the Payment of their Wages, Board-Wages, and the like. The Word is mentioned in the Act of Oblivion, 12 *Car.* 2. *c.* 2. and ſince the late Revolution hath been uſed in many Acts of Parliament, eſpecially in that which relates to the forfeited Eſtates in *Ireland*, out of which the Soldier's Debentures are appointed to be ſatisfied, 11 *W.* 3. *L.*

DEBET and *Solet*, is a Writ of Right which hath theſe Words in it, as formal Words not to be omitted; as if a Man ſue for any thing that is now firſt of all denied, and which hath been enjoyed by himſelf and his Anceſtors before him; as for a Mill, common Paſture, &c. then both *Debet* and *Solet* muſt be uſed in the Writ of Right. *L.*

DEBILITY, [*Debilitas*, *L.*] is a Weakneſs of the Body proceeding from Swooning, Fainting, Hunger, Diſeaſe, or otherwiſe. *Blanchard.*

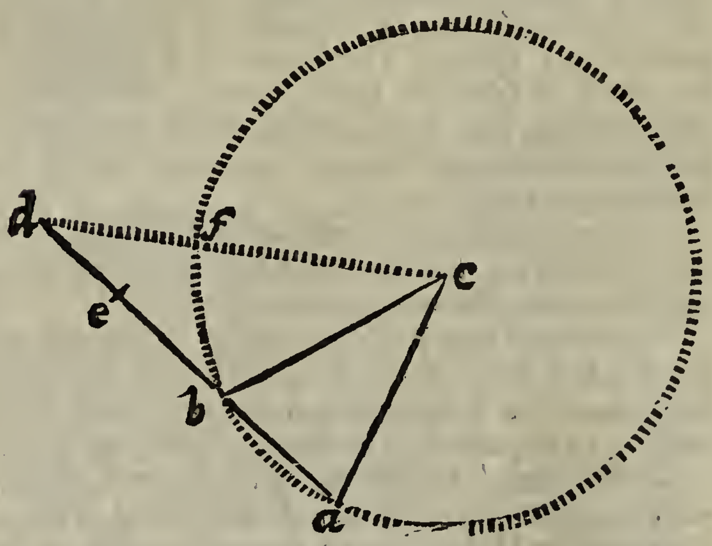
DEBITO, is a Writ that lieth where a Man oweth Money upon Obligation, or other Bargain for any thing ſold unto him. *L.*

DEBRUISED, a Term in Heraldry, when a *Pale*, *&c.* is born upon any Beaſt in an Eſcutcheon; for then they ſay, the *Beaſt is debruiſed of the Pale.*

DECAGON, [δεκάγων of δέκα ten and γωνία, *Gr.* a Corner.] is a plain Figure in Geometry, having 10 Sides and Angles; and if they are all equal to one another, 'tis then called a *Regular Decagon*, and it may be inſcribed in a Circle.

Propoſition.

The Side of a Regular Decagon is in Power and Length equal to the greateſt Segment of an Hexagon, cut according to Extreme and Mean Proportion. 9 e. 12. Euclid.



Let the Line db, the Radius or Side of an *Hexagon*, cut into Extream and Mean Proportion in e, (*P.* 11. *e.* 2. *Euclid.*) be applied to the Circle in the Point b, and then produced till ba be the Side of a *Decagon*, or the Chord of 36°.

I ſay ba is equal to be, and the $\square\, ba = be$.

Draw bc, ac, and dc.

Demonſtration.

The Angle $bca = 36°$, and conſequently the equal ones cba and a, each $= 72°$, wherefore dbc muſt be 108°. Alſo ſince $db = bc$, the $=$ Angles d and $dcb =$ muſt be exact $= 36°$. and therefore the whole Angle $acd = 72°$. or the Angle of a Pentagon; wherefore the $\triangle$'s abc and adc are Similar, and conſequently $ad : ac :: ac : ab$, that is, $ad : db :: db : ba$; wherefore the whole Line da is cut into Extream and Mean Proportion; and therefore, ſince db is alſo ſo divided by the Suppoſition, the whole Line $da : bd ::$ as the whole Line $db : ba$, but in the ſame Proportion is bd to be; wherefore ba muſt be equal to be, and the Power of one to the Power of the other.

A Fortification alſo conſiſting of 10 Baſtions, is ſometimes called a *Decagon.*

DECAMERIS, [of δέκα ten, and μερὶς, *Gr.* a Part] a tenth Part, a Term uſed by ſome Authors to mark and meaſure the Intervals of Sounds.

DECAMERON, a Work containing the Tranſactions or Converſation of ten Days. *Gr.*

DECAMP, when an Army raiſes its Camp, and departs from the Place where it lay before, they ſay it is Decamped.

DECANT; to Decant a Liquor is to pour off the clear Part of it by Inclination, as the Chymiſts ſpeak, that ſo it may be without any Matter or Sediment; and this Action the Chymiſts call a Decantation.

DECEMBER, [ſo call'd of *Decem* ten, *L.*] becauſe in *Romulus*'s Time the Year was begun in *March*, and ſo was their tenth Month.

DECEM TALES: See *Tales.*

DECEPTIONE, is a Writ that lieth againſt him that deceitfully doth any thing in the Name of another, for one that receiveth Damage or Hurt thereby. *L.*

DECIDUOUS, [*deciduus*, *L.*] is that which is apt or ready to fall, and is uſed in reference to the Flowers and Seeds of Plants: Thus the *Botaniſts* ſay, in ſome Plants the *Perianthium* or *Calyx* is deciduous with the Flower, *i. e.* falls from off the Plant with it, but in others it is not.

DECIES TANTUM, is a Writ which lieth againſt a Juror which hath taken Money for the giving of his Verdict; called ſo of the Effect, becauſe it is to recover ten times ſo much as he took. *L.*

DECIL, [in *Aſtronomy*] an Aſpect or Poſition of two Planets, when they are diſtant from each other a tenth Part of the Zodiack.

DECIMAL *Fraction*, is that which hath for its Denominator 1. with a Cypher or Cyphers annexed; as $\frac{5}{10}$, $\frac{6}{100}$, $\frac{64}{1000}$, *&c.*

Which Denominator, for Brevity and Convenience ſake, is moſt commonly expreſſed by a Point or a Comma ſet on the Left-hand of the Numerator; thus, .5 is $\frac{5}{10}$. .46 is $\frac{46}{100}$. and .125 is a Hundred Twenty-five Parts of any thing, ſuppoſed to be divided into 100 ſuch Parts.

N. B. As Cyphers ſet on the Right-hand of Integers do increaſe the Value of them Decimally, as 2, 20, 200, *&c.* ſo when ſet on the Left-hand of Fractions, they decreaſe the Value Decimally, as ,5. ,05. ,005. *&c.* but ſet on the Left-hand of Integers, or on the Right-hand of Fractions, they ſignify nothing, but only to fill up Places; thus, ,5000. or 0005. is but five Units.

1. To reduce any Vulgar Fraction, as ſuppoſe $\frac{5}{8}$ of a Pound, Shilling, Mile, Yard, Day, Hour, *&c.* to a Decimal Fraction of the ſame Value, whoſe Denominator ſhall be 1000; (I ſay 1000, for 10 or 100 are not large enough to do it without a Fraction.)

Say, by the *Rule of Three*, As 8 the Denominator of the Vulgar Fraction: Is to 5 its Numerator:: So will 1000 the Denominator aſſigned: Be to a 4th Term, which, by working, you'll find to be ,625. and therefore $\frac{625}{1000}$, or ,625. is a Decimal of the ſame Value with the former Fractions.

2. *Addition* and *Subtraction* of Decimals is performed juſt as Integers, only Care muſt be taken about duly placing each Part; as to which be ſure to place all the Points one under another, then add or ſubtract as in common Arithmetick, diſtinguiſhing from the Sum or Remainder ſo many Figures for Decimals, as are the moſt Decimal Places in any of the given Numbers, as in the following Examples:

In Addition,	,73567	64,58
	,705	9,7
	,86	,005
	,5	
	2,80067	74,285

In

In Subtraction, From	35,5
Take	20,68679
Remains	14,81321

From	16,05
Take	10,9999
Remains	5,0501

Multiplication of Decimal Fractions.

General Rule.

'Tis no matter in what Order either Multiplicand or Multiplicator ſtand, only obſerve, *That there muſt be juſt as many Decimal Parts cut off by the ſeparating Point from the Product, as there are Decimals in both Factors:* The Work is juſt as in Integers.

Example 1. Where one Decimal multiplies another.

,365
,22
730
730
,08030

Here the Product is only 8030, but a Cypher is prefix'd to make up the five Decimal Places, there being ſo many in both Factors.

,0006	,464
,5	,9
,00030	,4176

Example 2. Where one Factor is an Integer, the other a Decimal Fraction.

4,64	3,65	46,4
9	22	9
41,76	730	417,6
	730	
	80,30	

Note, That when a Decimal Fraction, or mix'd Number, is to be multiplied by an Unit, with Cyphers annexed thereto, as 10, 100, 1000, *&c.*) 'tis only removing the Separatrix ſo many Places towards the Right-hand in the Multiplicand, as there are Cyphers annexed to the Unit: Thus, if ,7652 were to be multiplied by

10	The Product will be	7,652
100		76,52
1000		765,2
10000		7652

The Reaſon of which is, becauſe there can be no more Decimals in the Product, than were in both the Factors; and the Cyphers any where on the Right-hand may be omitted, as being of no Value here.

By Multiplication, Decimals are reduced to the known Parts of ſuch Integers as they are Decimals of, *in this manner:* Multiply the given Decimal by the Number ſhewing how many known Parts of the next inferior Denomination are equal to that Integer, and purſue this as far as it will go, *v. gr.*

What is the Value of this Decimal ,8687 of a Day, or of a Pound Sterling, *&c.*

,8687 of a Day=20 h.	,8687 of a Pound=
24 (50′. 55″.	(20 17*s.* 4*d.* 1*q.*
34748	17,3740
17374	12
20,8488	7480
60	3740
50,9280	4,4880
60	4
55,6800	1,9520

To find the Value of any Decimal of a Pound of *Engliſh* Money, there is this ready Rule in Practice: Suppoſe it were required to find the Value of ,8687 of a Pound; double the firſt Figure 8, and becauſe 6 (the next Figure) exceeds 5, add the Exceſs, which is 1, to the former Double, and 'twill make it 17; account thoſe for Shillings: Then imagining that 1, by which 6 exceeded 5, to be taken as 10, and to ſtand before the next Figure 8, it will make 18; from which abate 1, and the Remainder 17 is the Farthings, which make 4*d.* 1*q.*

Alſo ,319 of a Pound=6 *s.* 4*d.* 3*q.*

If the Second Figure be juſt 5, add one to the Shillings, and account the third Figure for the Farthings; if it be leſs than 5, add nothing to the Shillings, but account it as ſo many Tens, the third Figure for Farthings.

Diviſion of Decimal Fractions.

General Rule.

Work in all Caſes, as in Diviſion of Integers, but only obſerve, that there be juſt as many Decimal Places (and no more) in the Diviſor and Quotient together, as there were in the Dividend.

22)8,030(,3,65	22)8,030(3,65	22)80,30(3,65
66	66	66
143	143	143
132	132	132
110	110	110
0	0	0

In Decimal Diviſion there are Nine Caſes, all performed by the General Rule, with a few Directions, as followeth.

1. To divide a whole Number by a greater whole Number;

To the Dividend add Cyphers at Pleaſure, and the Quotient will be all Decimal Parts, according to the Number of Cyphers added: Thus, if 22 were to be divided by 365.

365)22,0000(,602, *&c.*
2190
1000
730
270

2. To divide a leſſer whole Number by a greater mix'd Number ;
Add as many Cyphers to the Dividend, as (at leaſt) there are Places in the Diviſor :

Thus, 3,65)22,0000(6,02

Here, becauſe there are four Decimal Places in the Dividend (by the annexed Cyphers) and but two in the Diviſor, there muſt be two in the Quotient.

3. To divide a whole Number by a Decimal Fraction, annex (at leaſt) as many Cyphers to the Dividend, as there are Places in the Diviſor :

Thus, 3,65)22,0000(602

Here, there being three Places of Decimals in the Diviſor, and but three in the Dividend, there can be none in the Quotient.

4. To divide a mix'd by a whole Number :

22)8,030(3,65

Here, there being no Decimals in the Diviſor, but three in the Dividend, there muſt be three in the Quotient.

5. To divide a mix'd Number by a mix'd Number :

2,2(80,30(36,5

Here, the Dividend having two Places of Decimals, and the Diviſor one, there muſt be one in the Quotient.

6. To divide a mix'd Number by a Decimal Fraction, as if 80,30 were to be divided by ,365, here add three Cyphers to 80,30 the Dividend, becauſe it may have as many, or more, Decimal Parts than are in the Diviſor, and it will ſtand

Thus, 365)80,30000(22,00
730
730, &c.

And becauſe the Dividend hath five Places of Decimals, and the Diviſor but three, there muſt be two in the Quotient.

7. To divide a Decimal by a whole Number :

22),8030(,0365

Here needs no Cyphers be annexed, becauſe the Dividend is (apparently) bigger than the Diviſor ; but becauſe the Dividend has four Places in it, and the Diviſor none, a Cypher muſt be prefixed in the Quotient to ſupply it, and ſo the true Quotient will be ,0365.

8. To divide a Decimal by a mix'd Number :

3,65),8030(,22

Here, 'tis plain, the Quotient muſt be ,22, becauſe there are four Decimals in the Dividend, and but two in the Diviſor.

9. To divide one Decimal by another :

,22)8330(3,65

Here 'tis plain by the General Rule.

But ſometimes Cyphers muſt be added to the Dividend, as when the Diviſor is bigger than the Dividend :

Thus, 365),22,0000(,602

Where ſix Places of Decimals being in the Dividend, and three in the Diviſor, three muſt alſo be in the Quotient.

Note, *That when any Number, (either Decimal or Mix'd) is given to be divided by an Unite, with Cyphers annex'd thereto* (*as* 10, 100, 1000, &c.) *it is only removing the Separatrix in the Dividend ſo many Places farther toward the Left-hand, as there are Cyphers annexed to the Unite, prefixing Cyphers to the Dividend, to ſupply the vacant Places* (*if need be*) *:*

Thus, if 7562 were to be divided

By	10	The Quotient is	756,2
	100		75,62
	1000		7,562
	10000		,7562
	100000		,07562

DECIMAL *Scales* (*Vide Leybourne's Curſus*, p. 173.) are, in the General, any Scales that are divided Decimally. But for the expediting of Decimal Arithmetick, there are in Uſe ſome *Scales* of Money, Weights, Meaſures, which are made from Tables bearing thoſe Names, and ſerve readily, by Inſpection only, to ſhew you the Decimal Fraction which properly belongs to any Part of Weight, or Meaſure, *&c.* Theſe Scales are uſually placed on a ſquare Ruler, and are about Nine in Number :

1. One of *Engliſh* Coin, Two Shillings being the Integer.
2. *Troy* Weight, Two Penny-weight being the Integer.
3. *Averdupois* Great Weight, 28 *lb.* being the Integer.
4. *Averdupois* Little Weight, 16 *oz.* or 1 *lb.* being the Integer.
5. Liquid Meaſure, 36 Gallons being the Integer.
6. Dry Meaſure, Eight Buſhels being the Integer.
7. Long Meaſure, one Ell or Yard being the Integer.
8. Foot Meaſure, where 12 Inches is the Integer. And,
9. Time and Motion, where one Hour, Minute, *&c.* may be the Integer.

To every one of theſe there is joined another Decimal Scale, divided into 100 or 1000 equal Parts : So that if you look on any Diviſion in any of the nine Scales, you may eaſily ſee what Diviſion, or Part of a Diviſion, anſwers to it in the adjacent Decimal Scale : And conſequently it will very readily ſhew you what Decimal Fraction anſwers to any Part of Money, Weight, Time, Meaſure, *&c.* as well as it will give the Value of any Decimal Fraction in the correſponding Parts of any

Integer. Thus if in the Money Scale you take out any Part of Two Shillings, as ſuppoſe 8 Pence 3 Farthings, you will find the correſponding Decimal to be 464. Or if in the Decimal Scale contiguous to it, you would know what Part of Two Shillings anſwers to this Decimal Fraction .771, you will find the correſponding Point in the Money Scale, to be 18 Pence 2 Farthings: And ſo for the reſt.

DECIMIS *Solvendis pro poſſeſſionibus alienigenarum*, is a Writ, or Letters Patents, yet extant in the Regiſter, which lay againſt thoſe that had farm'd the Priors Aliens Lands of the King's, for the Rector of the Pariſh to recover his Tythe of them. *L.*

DECINERS, or *Decenniers*, or *Deſiners*. *Decennarii* [in our *Old Law*] were ſuch as had the Juriſdiction over 10 Friburghs, for keeping the King's Peace; and the Limits or Compaſs of their Juriſdiction was called a *Decenna*, ſaith *Bracton*, *Lib.* 3. *Tract.* 2. *Cap.* 15. In the *Saxons* Times, theſe ſeem to have had large Authority, taking Cogniſance of Cauſes within their Circuit, and redreſſing Wrongs by way of Judgment. In latter times, the Word came to ſignify ſuch an one, as by Oath of Loyalty to his Prince was ſettled in the Combination or Society of ſuch a Dozein; and a Dozein ſeems then to be extended as far as a Leet, becauſe in Leets only this Oath is adminiſtred by the Steward, and taken by all from 12 Years old and upward, that dwell within the Leet. Now there are no *Decenniers*, but *Leets*.

DECK *of a Ship*, is a Planked Floor on which the Guns lie, and the Men walk to and fro. In great Ships there are three Decks, Firſt, Second, and Third, beginning to account from the loweſt; and ſome alſo have an *Half Deck*, which reaches from the *Main Maſt* to the *Stem* of the Ship. There is alſo a *Quarter Deck*, which is from the Steerage aloft to the Maſter's Round-Houſe. There is alſo ſometimes a Spare Deck, which is the uppermoſt of all, and is between the Main Maſt and the Miſſen. This Deck is called alſo the *Orlope*: Which ſee.

DECK *Nails*, are ſuch as are uſed for faſtening Decks of Ships, doubling of Shipping, and for Floors laid with Planks. They are of two Sorts, *Dye-headed* and *Claſp-headed*. Their Sizes are from 4 to 9 Inches.

DECLARATION [in *Common Law*] is a ſhewing, in Writing, the Grief and Complaint of the Demandant or Plaintiff, againſt the Defendant or Tenant, wherein he is ſuppoſed to have received ſome Wrong: And this ought to be plain and certain, both becauſe it impeaches the Defendant, and alſo compels him to anſwer thereto.

DECLENSION *of a Diſeaſe*, is when it recedes from its Height, and the Patient is beyond Danger: See *Acme*.

DECLINATION *Apparent*, is the Diſtance of the apparent Place of a Planet from the *Equator*.

DECLINATION *of the Sun*, is the Diſtance of the Parallel to the Equator which the Sun runs in any Day, from the Equator itſelf: And this Diſtance (on the Globe) is reckon'd on the *Meridian*; and according as this Diſtance is towards either of the Poles of the World, 'tis called *North*, or *South Declination*.

To find the Sun's greateſt Declination, you muſt by ſome very large Quadrant, or ſuch like Inſtrument, take the Sun's greateſt Meridian Altitude, and his leaſt at the two Solſtices; the Difference between which is the Double of the Sun's greateſt Declination, or the Diſtance of the Tropicks; wherefore Half of it is the Thing ſought.

To find the Sun's, or Stars Declination by the Globe or Sphere, bring the Sun's Place, or the Star, to the Meridian, and the Degrees from the Equinoctial there reckoned, either North or South, are the Declination at Noon.

To find the Declination of the Sun Trigonometrically, having given his greateſt Declination and Diſtance from the next Equinoctial Point:

Say, *As the Rad. is to the Sine of the Sun's Diſtance from the next Equinoctial Point, ſo is the Sine of the Sun's greateſt Declination to the Sine of the preſent Declination.*

Example. Suppoſe the Sun's Diſtance from the next Equinoctial Point, to be 30°. 00. The greateſt Declination, 23°. 30′.

Then to the Sine of 30°. 00′. — 9,698970
Add the Sine of 23°. 30′. — 9,600700

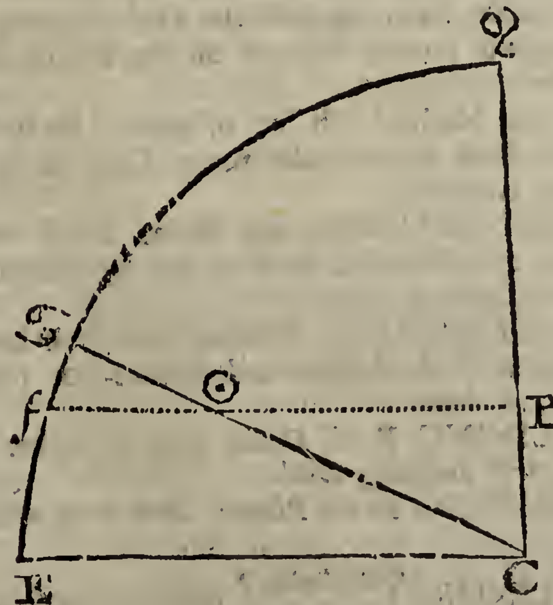
And the Sum (leſs Rad.) = Sine of 11°. 30′. — — 19,299670
which is the Sun's preſent Declination required.

How to find the Declination of a Planet or Star that hath Latitude. See *Newton's Aſtronom. Brit.* p. 10.

In the *Pythagorean* or *Copernican* Syſtem, the Sun's Declination is expreſs'd by the Complement of his Diſtance from the Pole, or by the Diſtance of the Pole from the Horizon of the Disk, and is called the *Reflection*. And the Proportion to find it is this:

As the Rad. to the Sine of the Diſtance of the two Poles of the Ecliptick and the Equator: So is the Sine of the Sun's Longitude to the Co-ſine of his Diſtance from the next Pole. The Complement of which laſt is the Reflection, the Diſtance of the Sun from the Horizon of the Disk, or his Declination.

To find readily the Declination of the Sun, by Projection of Part of the Analemma; having his Place in the Ecliptic, and his greateſt Declination. Draw E C for the Equinoctial, and P C for the Azimuth of Eaſt and Weſt, and with 60 Deg. of the Chords ſweep the Ark E P. Set 23 Deg. 30 Min.



Min. the Sun's greateſt Declination, from E to ♋, and draw ♋ C for one Quadrant of the Ecliptick. Set the Sine of the Sun's Longitude, or Diſtance from the next Equinoctial Point from C to ☉ in the Ecliptic C ♋, being, ſuppoſe, 42 Deg. then will the neareſt Diſtance from ☉ to E C, be the Sine of the Sun's preſent Declination = to P C = to the Ark F E, meaſured on the Chords.

DECLINATION *of the Mariners Compaſs*, is its Variation from the true Meridian of any Place. How to find this, ſee in *Variation*.

DECLINATION *True*, is the Diſtance of the True Place of a Planet from the Equator.

DECLINATION *of a Wall*, or *Plane for Dials*, is an Arch of the Horizon, comprehended either between the Plane and the Prime Vertical Circle, if you account it from the Eaſt or Weſt, or elſe between the Meridian and the Plane, if you account it from the North or South.

There are many Ways given by Authors, for finding the Declination of a Plane; of which, all thoſe that depend on the Magnetic Needle deſerve to be ſuſpected upon many Accounts. The common Method alſo, by finding the Sun's Horizontal Diſtance from the Pole of the Plane, is ſubject to many Errors and Difficulties. Mr. *Oughtred*'s Way, by a Semicircle drawn on a ſquare Board, is the plaineſt and eaſieſt Method that can be well thought on of that Nature; but then there is Difficulty in ſetting the Pin truly perpendicular, as well as in placing the Board truly horizontal; and at the ſame time is required the Sun's Declination and Azimuth to be had exactly. The very beſt Way therefore that I ever met with, for finding the Declination of a Plane, is to get, on a large ſquare Piece of Braſs or Wood, a Limb accurately divided into 360 Degrees, and (if it can be) every 5 Minutes, on the Centre of which moves an Horizontal Dial, purpoſely made for the Latitude of the Place, and which hath a ſmall Bit of fine Braſs fix'd on its Meridian Line, like a fiducial Edge, to cut the Degrees in the Limb. The Uſe of which is very eaſy; for at any time when the Sun ſhines, you need only apply that Side of the Square to the Plane where are 60 Degrees on the Limb; and then ſetting it as nearly as you can, horizontally, turn the Dial about, till it ſhew exactly the true Hour of the Day (which before muſt be rightly found, and a Watch ſet to it) and then will the fiducial Edge cut the Degrees of the Plane's Declination; and which way to account it will be eaſily ſeen, becauſe the Dial pointing true North, gives you an Idea of all the Points of the Compaſs.

And this Method will be of great Uſe to ſuch, whoſe Buſineſs is to make many Dials in or near the ſame Latitude.

DECLINATORIES, are Boxes fitted with a Compaſs and Needle, to take the Declination of Walls for Dialling, *&c.*

DEINCLINERS [in *Dialling*] are ſuch inclineing Dials as both decline and incline, or recline, at the ſame time.

DECLINING *Erect Dials*, how to make. See *Dial* in *erect declining Dials.*

DECLINING *Erect Planes.* See *erect declining Planes.*

DECLINING $\left\{\begin{array}{l}\textit{Reclining}\\ \textit{Inclining}\end{array}\right\}$ *Dials*, are thoſe whoſe Planes neither face directly any of the four Cardinal Points; nor are they either perpendicular or parallel to the Horizon.

For the deſcribing of theſe Dials; firſt, make an erect one for the given Declination, according to the Direction in *erect declining Dials*; then let the Height of the Stile above the Subſtile be the $\left\{\begin{array}{l}\text{Difference between}\\ \text{Sum of}\end{array}\right\}$ the Co-latitude of $\left\{\begin{array}{l}\textit{Inclination,}\\ \textit{Reclination.}\end{array}\right.$

DECLINING $\left\{\begin{array}{l}\textit{Reclining}\\ \textit{Inclining}\end{array}\right\}$ *Plains.* See *Dial Plan*

DECLIVIS *Muſculus.* See *Obliquus deſcendens ſeu Declivis.*

DECOCTION, is a boiling of ſome Plants, Roots, Seeds, *&c.* for Medicinal Uſe, being the ſame as *Apozem*: Which ſee. *L.*

DECOMPOSITION [in *Chymiſtry*, &c.] the ſame as Analyſis or Reſolution, *&c.* the Reduction of a Body into the Principles or component Parts it conſiſts of.

DECORATION [in *Architecture*] an Ornament in a Church, or other publick Place, or what adorns or enriches a Building, Triumphal Arch, *&c.*

DECORATION, the peeling or unhusking of Roots, Seeds, Fruits, *&c.* or the freeing of them from their Barks, Rinds, Husks, or Shells. *L.*

DECORUM or *Decency* [in *Architecture*] is a ſuiting of all the Parts and Ornaments of a Building, ſo as they ſhall become the Station; as *Vitruvius* ſhews, when he ſpeaks of adjuſting the ſeveral Orders to their natural Affections; and he, as Mr. *Evelyn* obſerves, would never have placed a *Corinthian* Column at the Entrance into a Priſon, nor one of the *Tuſcan* Order before the *Portico* of a Church.

DECREE [in the *Civil Law*] is a Determination that the Emperor pronounces, upon hearing a particular Cauſe between Plaintiff and Defendant.

DECREPITATION *of Salt*, or *of Sal Gemmæ*, is a Word uſed by the Chymiſts for a kind of Calcination of Salt, thus; An Earthen unglazed Pot is heated red hot over the Fire, and then an Ounce of Salt is thrown into it, and the Pot is preſently covered; a great cracking Noiſe ariſes, whence comes the Word *Decrepitation.* If more Salt be to be decrepitated, the Pot muſt be kept ſtill red hot, and you muſt proceed as at firſt. The Deſign of it is to free the Salt from ſuperfluous Moiſture; but it renders the Salt ſo porous and apt to imbibe the Humidity of the Air, that it muſt always be kept in a Phial well ſtopp'd, or elſe the Air will ſoon moiſten it anew.

DECRETALS, are a Volume of the Canon-Law, containing the Decree of ſeveral Popes; or elſe a Digeſt of the Canons of all the Councils pertaining to one Matter, and under one Head.

DECUPELATION, the ſame with *Decantation.* Which ſee.

DECUPLE [*Decuplex, L.*] a Term in *Arithmetick*, of Relation or Proportion, implying a Thing to be ten times as much as another.

DECUSSATION [a Term in *Opticks*] is the croſſing of any two Lines, Rays, *&c.* when they meet in a Point, and then go on apart from one another.

DECUSSORIUM is a Surgeon's Inſtrument, wherewith the *Dura Mater* being highly preſſed, is accurately adjoined to the Skull, that the purulent Matter gathered betwixt the Skull and the Skin, called *Dura Meninx*, or *Mater*, may be evacuated by a Hole made with a Surgeon's Inſtrument, called *Trepanum. Blanch.*

DECYPHERING, the Art or Act of finding the Alphabet of a Cypher, or of explaining a Letter written in Cyphers.

DEDI, is a Warranty in Law, to the Feoffee and his Heirs, as if it be ſaid in a Feoffment, *A. B.* has given and granted, *&c.* they call it a *Warranty.*

DEDIMUS *Poteſtatem*, is a Writ whereby a Commiſſion is given to a private Man, for the ſpeeding of ſome Act appertaining to a Judge; and by the *Civilians*, is called *Delegation.* *L.*

DEEDS [in *Common Law*] ſignify Writings, that contain the Effect of a Contract made between Man and Man. See more in *Fait.*

DEEMSTERS, are a kind of Judges in the *Iſle of Man*, choſen from among, and by themſelves, who, without Proceſs, Writing, or Charge, decide all Controverſies there.

DE DEONERANDA *pro rata portionis*, is a Writ that lies where a Man is diſtrained for Rent that ought to have been paid by others proportionably. *L.*

DEEP *Sea-Line*, is a ſmall Line to ſound with, when a Ship is in very deep Water at Sea; at the End of it is a Piece of Lead, called the *Deep-Sea-Lead*, at the Bottom of which is a *Coat* of White Tallow, to bring up Stones, Gravel, Sand, Shells, or the like, from the Bottom, and to know the Differences of the Ground, which having been before diſcovered by other Obſervations, and entered in their Books, they gueſs, by their Soundings, what Coaſts they are upon, tho' they cannot ſee Land. If it happens that no Ground come up upon the Tallow, they gueſs they are upon Ouzy Ground, which they diſcover by ſounding again with a Woollen Cloth upon the Lead, whereby this Ground will be brought up.

DE *Eſſendo quietum de Telonio*, is a Writ which lieth for them which are by Privilege freed from the Payment of Toll. *L.*

DE *Expenſis Militum*, is a Writ, commanding the Sheriff to levy ſo much a Day for the Expences of a Knight of the Shire; and a like Writ to levy Two Shillings a Day for every Citizen and Burgeſs, call'd *De expenſis Civium & Burgenſium.* *L.*

DEFAULT [in *Heraldry*] a Term uſed of a Beaſt whoſe Head is cut off ſmooth, in which it differs from *eraſed*, where it is as it were torn off, and the Neck left ragged.

DEFAULT, is a Neglect or Omiſſion of Appearance before a Court of Juſtice, for which Judgment may be given againſt the Defaulter.

DEFECTIVE or *Deficient Nouns* [in *Grammar*] are ſuch as want either a Number, a particular Caſe, or are Indeclinable.

DEFEISANCE, DEFEIZANCE, ſignifies [in *Law*] a Condition relating to a Deed, as an Obligation, Recognizance, or Statute, which being performed by the Obligor or Recognizor, the Act is diſabled and annulled, as if it had never been done. The Difference between a Proviſo or a Condition in Deed, and a Defeizance, is this: That a Proviſo or Condition is annexed or inſerted in the Deed or Grant, whereas a Defeizance is uſually a Deed by itſelf.

DEFENCES [in *Fortification*] are all ſorts of Works that cover and defend the oppoſite Poſts, as Flanks, Parapets, Caſemates, Fauſſe-Brays. 'Tis almoſt impoſſible to fix the Miner to the Face of a Baſtion, till the Defences of the oppoſite one are ruin'd; *i. e.* till the Parapet of its Flank is beaten down, and the Cannon in all Parts that can fire upon that Face which is attacked, are diſmounted.

DEFEND [in our ancient Laws and Statutes] ſignified to prohibit and forbid. *Leg. Edw. Confeſſ. c.* 37. and 5 *R.* 2. *c.* 7. And in this Senſe *Chaucer* alſo uſes it.

DEFENDANT [a Term in *Law*] is he that ſueth in an Action perſonal, as Tenant, is he which is ſued in an Action real.

DEFENDEMUS, a Word uſed in a Feoffment or Donation, and bindeth the Donor and his Heir to defend the Donee.

DEFENSIVE, or *Defenſitive Medicines* [in *Surgery*] are Remedies applied outwardly, to prevent an Inflammation, or any other Symptom that ſeems to threaten any Part, from arriving ſo far as to that Part.

DEFERENT [in *Aſtronomy*] an imaginary Circle or Orb (in the *Ptolemaick Syſtem*) which is there ſuppoſed, as it were to carry about the Body of the Planet. 'Tis the ſame with the *Eccentrick.* The two Points where the Epicycle interſects the Deferent, are called *the Points of the greateſt Elongation.*

DEFERENTS [in *Anatomy*] certain Veſſels of the Body appointed for the Conveyance of Humours from one Place to another. See *Deferentia Vaſa.*

DEFERENTIA *Vaſa.* See *Vaſa Deferentia.*

DEFICIENT *Nouns.* See *Defective.*

DEFICIENT *Numbers* are ſuch, whoſe Parts added together, make leſs than the Integer, whoſe Parts they be; as Eight, whoſe Parts being One, Two, and Four, make but Seven: Likewiſe the Parts of Sixteen make but Fifteen, and of Forty-five make but Thirty-three.

DEFICIENT *Hyperbola*, is a Curve of that Name, having but one Aſſymptote, and only two Hyperbolick Legs running out infinitely towards the Side of the Aſſymptote, but contrary ways. See *Curves.*

DEFILE [in *Fortification*] is a ſtraight narrow Lane or Paſſage, thro' which a Company of Horſe or Foot can paſs only in File, by making a ſmall Front, ſo that the Enemy may take an Opportunity to ſtop their March, and to charge them with ſo much the more Advantage, in regard that thoſe in the Front and Rear cannot reciprocally come to the Relief of one another. Hence, to go off File by File, is called *Defiling.*

DEFINITE [in *Grammar*] is applied to an Article or Tenſe of a Verb, that has a preciſe or determinate Signification.

DEFINITION is an exact Deſcription, explaining the Nature of a Thing by eſſential Attributes. And there are three things neceſſary to make a Definition good.

1. It muſt be Univerſal; *i. e.* it muſt contain the whole Thing defined; therefore (as the Author of the *Art of Thinking* would have it) the common Definition of Time to be the Meaſure of Motion, is not good; for Time may be the Meaſure of Reſt as well as Motion.

2. It muſt be proper, that is, it muſt agree with the Thing defined.

3. It muſt be clearer than the Thing defined that is, it ought to render the Idea of it more plain and diſtinct; and make us as much as may be to underſtand the Nature of it, and be ſerviceable to us to give a Reaſon of its principal Properties, which is that which we ought chiefly to conſider in Definitions.

DEFLAGRATION [in *Chymiſtry*] is the enkindling and burning, in a Crucible, a Mixture of Salt or ſome Mineral Body, with a Sulphurous one, in order to make a Purification of the Salt, or a Regulus of the Mineral: Of which ſee *Sal Prunella* and *Regulus of Antimony.*

DEFLECTION [in *Navigation*] is the Tendency of a Ship from her true Courſe, by Reaſon of Currents, *&c.* which divert her, and turn her out of her right way.

DEFLECTION *of the Rays of Light*, is a Property which Dr. *Hook* obſerved 167$\frac{4}{5}$, and read an Account of it before the Royal Society, *March* 18. the ſame Year. He ſaith, he found it different both from Reflection and Refraction, and that it was made towards the Surface of the opacous Body perpendicularly. This is the ſame Property which Sir *Iſaac Newton* calls *Inflection*; of which, ſee an Account under that Word.

DEFLORATION, a Deflowering, the Act of taking away a Woman's Virginity, the Penalty of which is Death or Marriage.

DEFLUVIUM, is a Diſtemper in Trees, whereby they loſe their Bark; 'tis cauſed by a ſharp Humour, that diſſolves the Glew whereby the Bark is faſtned to the Wood; and ſometimes by too much Drought. *L.*

DEFLUXION: See *Catarrh.*

DEFORCEMENT, in the Law Senſe, is withholding Lands or Tenements by Force from the Right Owner. Wherefore a

DEFORCEOR, is he that overcometh and caſteth a Perſon out by Force.

DEFORCIATIO, is a Diſtraint or Seizure of Goods for Satisfaction of a lawful Debt. In Aſſizes and Trials formerly, the Claimer or Plaintiff was called *Quærens*, and the Poſſeſſor or Defendant was called *Deforcians*: Tho' indeed the Original Senſe of the Verb *Deforciare* is to keep Poſſeſſion ones ſelf, or to turn another out of his by Violence and Force.

DEGLUTITION, Swallowing, is an Animal Action, whereby Meat chew'd in the Mouth, or any thing more liquid, deſcends into the Stomach by the Motion and Contraction of the Fibres of the Gullet. *Blanchard.*

DEGRADATION, is a Term in Painting, which expreſſes the leſſening and rendering confuſed the Appearance of diſtant Objects in a Landskip, ſo as they ſhall appear there as they would to an Eye placed at that Diſtance from them.

DEGRADING, or, as it has ſometimes been written, *Diſgrading*, is the Puniſhment of a Clerk, that being deliver'd to his Ordinary, can't purge himſelf of the Offence whereof he was convicted by the Jury; and it is the Privation of him from thoſe Holy Orders which he had, as of Deacon, Prieſt, *&c.*

Formerly alſo Knights have been degraded. See 18 *E.* 2.

In the Common Law alſo there are two Sorts of Degrading; one Summary, by Word only; the other Solemn, by diveſting the Party degraded of thoſe Orders and Rites, which are the Enſigns of his Order and Degree. See 13 *Car.* 2. *c.* 15.

DEGREE, is the 360th Part of the Periphery of a Circle, it is ſub-divided into 60 Parts, called *Minutes*, and each of them again into 60 Parts more, called *Seconds*, and ſo into *Thirds*, *&c.*

DEGREE *of a great Circle*, on the Surface of the Earth (ſuppoſing it be of a Spherical Figure) is 69 *Engliſh* Miles and 288 Yards; as appears by the Concurrent Menſurations, nearly, of Mr. *Norwood* and the *French* Mathematicians. The *French* make a Degree 365184 Feet *Engliſh*, and Mr. *Norwood* 367196, the Difference being only 597 Yards, or 1791 Feet: And from hence, the Circumference of the Earth will be 24899 *Engliſh* Miles.

DEGREE *Parodick*: See *Parodical.*

DEGREES *of Fire*: The Chymiſts reckon Four Degrees of Fire. The firſt is made by only 2 or 3 Coals, and is the moſt gentle Heat of all. The 2d is with 4 or 5 Coals, or only juſt to warm the Veſſel ſenſibly, but ſo that you may endure your Hand upon it for ſome Time. The 3d Degree is when there is Heat enough to make a Pot boil that is full of 5 or 6 Quarts of Water. The 4th Degree is as great a Heat as can be made in a Furnace; but all theſe muſt admit of ſome Variations, according to the Circumſtances of the Operations, Furnaces, Veſſels, Quantity of Matter, *&c.*

DEJECTION, the ſame with *Ejection*; is going to Stool, or an Evacuation of the Excrements by the Periſtaltick Motion of the Guts.

DELEGATES, in Law, are Commiſſioners delegated or appointed by the King's Commiſſion, to ſit upon an Appeal to him in the Court of Chancery, and is granted in three Caſes; Firſt, When a Sentence is given in any Eccleſiaſtical Cauſe by the Archbiſhop, or his Official. Secondly, When a Sentence is given in any Eccleſiaſtical Cauſe in Places exempt. Thirdly, When Sentence is given in any Admiralty in Suits Civil or Marine, by order of the Civil Law.

DELEGATION, in the Civil Law is a kind of *Novation*, whereby a Debtor appoints one that is Debtor to him, to anſwer a Creditor in his Place.

DELETERIOUS [of δηλέω, *Gr.* to hurt] or *Deletery Medicines*, are ſuch Things or Particles as are of a poiſonous Nature.

DELF, one of the Abatements of Honour in Heraldry, being a Square in the Middle of the Eſcutcheon. See *Abatements of Honour.*

DELIGATIO, Swathing, is a Part of Surgery that concerns the binding up of Wounds, Ulcers, broken Bones, *&c.* and it is either Simple or Compound: The Simple is either equal or unequal; the equal is only round, which ſwathes the affected Member without any Declenſion to either Side; the unequal is divided into *Aſcia* and *Sima*, which at leaſt differ upon the Account of one being greater and the other leſs; *Aſcia* declines little from a Round, but *Sima* much. There are a great many more Diſtinctions of Swathing, taken from the Likeneſs of the Parts which are ſwathed, or from certain Animals and other Things. *Blanchard.*

DELIQUIUM *Animi*, Swooning, the ſame with *Eclipſis*, *Lipothymia*, *Syncope*, *Aſphyxea*, *Lipopſychia*, *&c.*

DELIQUIUM *Chymicum*, is either a Diſtillation by the Force of Fire; or a melting of the Calx, which is ſuſpended in moiſt Cellars, and a Reſolution of it into Lixivious Humour; thus when Salt of Tartar, or any ſuch fixed Alkali is ſet in a Cellar or ſome ſuch cool Place in an open Veſſel, it will run into a kind of Water, which the Chymiſts call *Oil of Tartar per Deliquium.*

DELIRIUM, is a Depravation of the Imagination and Judgment, ariſing from a tumultuary and diſorderly Motion of the animal Spirits, occaſioned by a Fever; whereupon the Perſons affected ſpeak ſeveral abſurd and incongruous things. *L. Blanchard.*

DELIACAL *Problem*, a curious Problem among the Ancients, about the Duplication of the Cube.

DELPHINUS, the *Dolphin*, in Aſtronomy, a Conſtellation in the Northern Hemiſphere. The Number of Stars in this Conſtellation, according to *Ptolemy*, are 10; according to *Tycho*, 10; and according to Mr. *Flamſtead*, 18.

DELTOIDES, is the Name of a triangular Muſcle, in Form like the *Greek* Letter Δ; it proceeds from the *Clavicula* or Channel-Bone, from the upper Proceſs of the Shoulder-Blade, and from the Proceſs of the ſame, which is called *Spiniforme*; and being faſtened to the Middle of the *Os humeri*, lifts it directly upwards, or ſomewhat forwards or backwards, according to the Direction of its differing Series or Fibres.

DELUGE, the ſame with an Inundation or overflowing of the Earth, either in part, or in the whole, by Water. There have been ſeveral very notorious Deluges or Floods, whoſe Memorials are recorded in Hiſtory; as that of *Ogyges*, which overflow'd almoſt all *Attica*; and that of *Deucalion*, which drowned all *Theſſaly* in *Greece*; but the moſt terrible one that ever was, was that which is uſually, and very properly, called the *Univerſal Deluge*, or *Noah's Flood*, which overflow'd and deſtroy'd the whole Earth, and out of which only *Noah*, and thoſe with him in the Ark eſcaped.

Men have been very ſolicitous to account for this diſmal Judgment Philoſophically, and to diſcover from whence ſuch an amazing Quantity of Water could come, as was neceſſary to cover all our Globe to the Height of 15 Cubits above the higheſt Hills; for to that Height, *Moſes* ſaith expreſly, *Gen.* vii. 20. *the Waters prevailed*; and ſome have made ſo bold with him, as to deny there were any Mountains at all before the Flood, though he expreſly mentions them as a Standard for the Height of the Water; and others have denied the Univerſality of the Deluge, though the Text be as plain as Words can deliver, *That all the Hills over the whole Earth were covered.* Others have had recourſe to the ſhifting of the Earth's Center of Gravity, and ſo will have its Parts all drowned ſucceſſively: And our famous Theoriſt, Dr. *Burnet*, makes an Earth as it were on Purpoſe to be drowned at that time; which being in the Form of an orbicular Cruſt on the Face of the Sea (as we now call it, for he ſaith there was none before the Deluge) fell down into the Water, and ſo drowned its Inhabitants.

Now for my own part, I ſhould not at all be in care how to find Water for ſuch a Cataſtrophe, if that were all that appeared neceſſary to enquire after; for I could eaſily believe, that the Great Creator of the World could ſoon either educe *Subterranean*, bring down *Superceleſtial*, or create Waters on purpoſe for ſuch an Occaſion; for nothing can be too hard for Omnipotence to effect; and I dare not make my Underſtanding a Judge how far it may be expedient for Him to make uſe of his Almighty Power without Secondary Cauſes.

But the Matter lies not here, the *S. S.* tell us, that the Waters of the Deluge came from two Funds, the *Great Deep below*, and the *Rains above*; to theſe therefore we muſt ſtick, and look no further. Again, when we look into the Internal Parts of the Earth, even to the greateſt Depth Men have ever digg'd or min'd, we find there that the Body of the Terreſtrial Globe is compos'd of *Strata*, Rows or Layers lying one over another, and which appear to every one that obſerves them to be Sediments of a Flood; beſides, in the Bodies of theſe *Strata*, though never ſo ſolid, nay even incloſed within the Solidity of the firmeſt Flints, Marble, Stone, *&c.* we find a prodigious Variety of the *Exuviæ* or Remains of Fiſhes, ſuch as their Shells, Teeth, *&c.* as well Marine ones, as thoſe which live in Lakes and Rivers: And from a due Obſervation of theſe, and repeated Conſiderations upon them, it was, that the Learned and Ingenious Dr. *Woodward*, Profeſſor of Phyſick in *Greſham College*, founded what he delivers upon this Subject; which therefore is not ſo much a *Theory*, as neceſſary Deductions, and unavoidable Conſequences drawn from Matter of Fact.

And from hence it is, and hence only, that he deduces the following *Inferences* relating to the *Univerſal Deluge*, in his *Natural Hiſtory of the Earth*; which appear to me very reaſonable, and are theſe.

1. That theſe Marine Bodies, and the other Spoils of Freſh-water Fiſhes, were born forth of the Sea by the Univerſal Deluge, and on Return of the Water back again from off the Earth, they were left behind at Land.

2. That during the Time of the Deluge, whilſt the Water was out upon, and covered the Terreſtrial Globe, all the Stone and Marble of the Antediluvian Earth; all the Metals in it; all the Mineral Concretions; and in a Word, all Foſſils whatever that had before attained any Solidity, were totally diſſolved; their conſtituent Corpuſcles were disjoined, and their Coheſion perfectly ceaſed; and that the ſaid Corpuſcles of thoſe ſolid Foſſils, together with the Corpuſcles of thoſe which were not before ſolid, ſuch as Sand, Earth, and the like; as alſo all Animal Bodies and Parts of Animals Bones, Teeth, Shells; Vegetables, and Parts of Vegetables, Trees, Shrubs, Herbs; and, to be ſhort, all Bodies whatſoever that were either upon the Earth, or that conſtituted the Maſs, if not quite down to the Abyſs, yet quite down to the greateſt Depths we ever dig; all theſe, he ſays, were aſſumed up promiſcuouſly into the Water, and ſuſtained in it, in ſuch manner, that the Water, and Bodies in it, together made up one common Maſs.

3. That at length all the Maſs that was thus born up in the Water, was again precipitated and ſubſided toward the Bottom: And that this Subſidence happened generally according to the Laws of Gravity: That Matter, Body, or Bodies which had the greateſt Quantity or Degree of Gravity, ſubſiding firſt in order, and falling loweſt; that which had the next, or a ſtill leſſer Degree of Gravity ſubſiding next after; and ſo in their ſeveral Courſes: That which had the leaſt Gravity ſinking not down till laſt of all, but ſettling at the Surface of the Sediment, and covering all the reſt: That the Matter ſubſiding thus, form'd the Strata of Stone, Earth, Marble, Coal, *&c.* of which Strata lying one upon another, the Terreſtrial Globe, or at leaſt as much of it as hath ever been diſplayed to Human View, doth mainly conſiſt.

4. That the Strata of Marble, Stone, and of all other ſolid Matter attained their Solidity, as ſoon as the Sand or other Matter, whereof they conſiſt, was arrived at the Bottom, and well ſettled there; and that all thoſe Strata which are ſolid at this Day, have been ſo ever ſince that time.

5. That theſe Strata lying thus one on another, were all originally parallel; and they were plain, even and regular, rendring conſequently the Surface of the Earth even and ſpherical; that they were contiguous, and not interrupted or broken as we find them now; and that the whole Maſs of the Water lay then upon them, above them all, and conſtituted a Fluid Sphere environing round all the Globe.

6. That after ſome time, by the Force of an Agent ſeated within the Earth, theſe Strata were broken on all ſides the Globe; that they were diſlocated, and their Situation varied, being elevated in ſome Places, and depreſſed in others; and from hence aroſe all the Mountains, Valleys, and other

Inequalities of our preſent Earth's Surface; all the Caverns and Grotto's, all the Perpendicular and Horizontal Fiſſures; the Channel of the Sea, all Iſlands, *&c.* In one word, the whole Terraqueous Globe was put, by this Diſruption and Diſlocation of the Strata, into the Condition which we now behold it. *Nat. Hiſt. of the Earth*, Part 2.

And afterward, in Part the 3d, conſidering farther this Matter of the Univerſal Deluge, he concludes from his Obſervations;

1. That the Deluge of *Noah* was truly Univerſal, and laid the whole Earth under Water, covering all, even the higheſt Mountains, quite round the Globe.

2. That at the time of the Deluge, the Water of the Ocean was firſt brought out on the Earth, and that it was immediately ſucceeded by that of the Abyſs, which was alſo brought out on the Surface of the Globe.

3. That upon the Diſruption of the Strata, and the Elevation of ſome, and the Depreſſion of others of them, which followed after that Diſruption towards the End of the Deluge, this Maſs of Water fell back again into the depreſs'd and loweſt Parts of the Earth, into Lakes and other Cavities into the *Alveus*, or Channel of the Ocean; and through the Fiſſures whereby this communicates with the Ocean in the Abyſs, which it filled till it came to an *Æquilibrium* with the Ocean.

4. That the Deluge commenced in the Spring Seaſon, the Water coming forth upon the Earth in the Month which we call *May*.

5. That the Deluge did not happen from an accidental Concourſe of Natural Cauſes, but that many things were then done, which never could poſſibly have been done without the Aſſiſtance of Supernatural Power: That the ſaid Power acted in this Matter with Deſign, and with the higheſt Wiſdom: And that as the Syſtem of Nature was then, and is ſtill ſupported and eſtabliſhed, a Deluge neither did nor could happen naturally.

The Learned and Ingenious Mr. *Whiſton*, in his *New Theory of the Earth*, ſuppoſes, and indeed makes it very probable from ſeveral ſurpriſing Co-incidences (as the exact Correſpondence between the Solar and Lunar Year, ſuppoſing, as he doth, that the Earth moved in a Circular Orbit before the Deluge: That the Earth at the Time of the Deluge ſhould be in its Perihelion, which is indeed the natural Effect of a Comet's paſſing by at that time, and drawing it from a Circular to an Elliptical Orbit: And alſo, That the Moon was then in ſuch a Place of its Orbit, as to be equally attracted by the Earth when the Comet paſſed by; I ſay, he renders it very probable) that a Comet deſcending in the Plane of the Ecliptick towards its Perihelion, paſſed juſt before the Earth on the firſt Day of the Deluge: The Conſequences of which he thinks would be, that this Comet, when it came below the Moon, would raiſe a prodigious, vaſt and ſtrong Tide, both in the ſmall Seas, which, according to his Hypotheſis, were in the Antediluvian Earth, for he allows no great Ocean there, (as in ours) and alſo in the Abyſs, which was under the upper Cruſt of the Earth. This Tide he ſuppoſes would riſe and increaſe all the time of the Approach of the Comet towards the Earth, and would be at its greateſt Height when the Comet was at its leaſt Diſtance from it. By the Force of which Tide, and alſo by the Attraction of the Comet, he judges, that the Abyſs muſt put on an Elliptick, or rather exactly Oval Figure, whoſe Surface being much larger than the former Spherical one, the outward Cruſt of the Earth incumbent on the Abyſs, muſt needs accommodate itſelf to that Figure, which yet it could not poſſibly do while it held ſolid and conjoined together; and therefore he concludes, that it muſt of neceſſity be extended, and at laſt broken by the violent Force of the ſaid Tide and Attraction, and conſequently have innumerable Gaps and Clefts made quite through it, out of which the included Water of the Abyſs muſt iſſue, and ſo help to occaſion the Deluge.

He ſuppoſes further, that this Comet in its Deſcent towards the Sun, paſſed ſo cloſe by the Body of the Earth, as to involve it in its Atmoſphere and Tail for a good while, and conſequently left a vaſt Quantity of Vapours both expanded and condenſed on its Surface; a great Part of which being very much rarefy'd after their firſt Fall, would be ſoon drawn up into the Air again, and afterwards fall down on the Earth in vaſt and prodigiouſly violent Rains; which was the Cauſe of the forty Days Rain mentioned by *Moſes* in his Hiſtory of the Deluge. But the other great Rain, which with this laſted for 150 Days, was cauſed (he ſaith) by the Earth's coming a ſecond time into the Tail of the Comet: And from this double coming of the Earth into, firſt, the Atmoſphere, and then the Tail of the Comet, he ſuppoſes half the Water of the Deluge to be derived, as the other half came from the Abyſs; whoſe Waters he ſuppoſes were continued to be brought out from the Preſſure of that Water which came from the Comet, which he thinks would preſs downwards with a mighty Force, and endeavour to ſink the outward Cruſt of the Earth down into the Abyſs, and this would force the Subterranean Water up through the Clefts and Fiſſures before made in the Cruſt by the Violence of the Tide above-mentioned. And at laſt, to remove this vaſt Orb of Waters again, he ſuppoſes a mighty Wind to have ariſen, which dried up ſome, and forced the reſt down into the Abyſs through the Clefts or Fiſſures by which it came up in a good meaſure before; only that a good Quantity indeed retired into the *Alveus* of the great Ocean (now firſt made) and into leſſer Seas and Lakes, *&c.* From the Calculation of this Comet he concludes, that the Deluge began on the 17th Day of the ſecond Month from the Autumnal Equinox (or on the 27th Day of *November*, in the *Julian* Stile extended backward) in the 2365th Year of the *Julian* Period, and in the 2349th Year before the Chriſtian *Æra*. He aſſerts alſo, that the Waters of the Deluge were ſtill, calm and free from Commotions, Storms, Winds and Tempeſts of all ſorts, during the whole time the Ark was afloat upon them: That at the Deluge the Earth was firſt divided into two vaſt Continents almoſt oppoſite to one another, and ſeparated by a vaſt Ocean, as it is now; and alſo, that ſince the Deluge, there neither hath nor will be any great or general Changes in the State of the World, till a Period be put to the preſent Courſe of Nature. How he makes out theſe things, the Reader will find in his *New Theory of the Earth*, which is very well worth the careful Peruſal of every Mathematical and Philoſophical Reader.

DEMAINE, or *Demeſn*, *Dominicum*, is a *French* Word, otherwiſe written *Domaine*, and ſignifieth, as *Hottoman* ſaith, *Patrimonium Domini*, *in verbis feudalibus*, *verbo Dominicum*, where, by divers Authorities, he proveth thoſe Lands to be *Dominicum*, which a Man holdeth originally of himſelf, and thoſe to be *feodum* which he holdeth of a Superior Lord.

In *England* no common Perſon hath any *Demaines* ſimply underſtood, for all dependeth either mediately or immediately on the Crown; for when a Man in pleading would ſignify his Land to be his own, he ſaith, that he is or was ſeiz'd thereof in his Demaine, as of Fee, *Lit. Lib.* 1. *C.* 1. whereby he meaneth, that although his Land be to him and his Heirs for ever, yet it is no true Demaine, but dependeth upon a Superior Lord, and he holdeth by Service, or Rent in lieu of Service, and by both Service and Rent.

This Word Demaine is diverſly taken; ſometimes more largely, as of Lands and Tenements held for Life, *&c.* and ſometimes more ſtrictly, as for ſuch only as are generally held in Fee. This Word is ſometimes uſed for a Diſtinction between thoſe Lands that the Lord of the Manor hath in his own Hands, or in the Hands of his Leſſee, demiſed upon a Rent for Term of Years or Life, and ſuch other Lands appertaining to the ſaid Manor, which belongeth to the Free or Copy-holders. And the reaſon why Copy-hold is accounted Demaines, is, becauſe they that be Tenants to it, are judged in Law to have no other Right, but at the Will of the Lord; ſo that it is reputed ſtill, after a ſort, to be in the Lord's Hands: And yet in common Speech that is ordinarily called Demeans, that is, neither Fee nor Copy. Note alſo, that Demaine is ſometimes uſed in a more ſpecial Signification, and is oppoſite to *Frank-Fee:* For Example, thoſe Lands which were in the Poſſeſſion of *Edward the Confeſſor,* are called *Ancient Demaine,* and others be called *Frank-Fee. Kitchin,* Fol. 98. And the Tenants which hold any of thoſe Lands, be called *Tenants in Ancient Demaine*; the other, *Tenants in Frank-Fee,* and alſo Tenants of the Common Law; the Reaſon is, becauſe *Tenants in Ancient Demaine* cannot be ſued out of the Lord's Court.

DEMANDANT, is the Plaintiff in a real Action, and ſo called becauſe he demandeth Lands, *&c.*

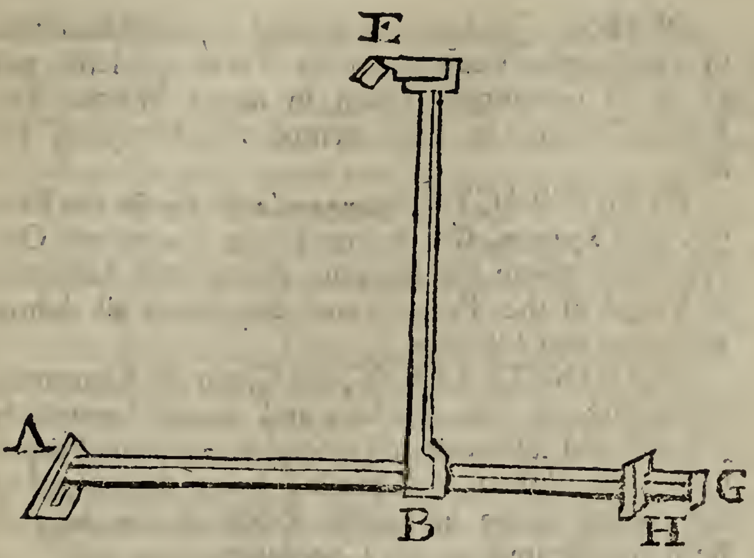
DEMI-BASTION, is a kind of Fortification that has only one Face and one Flank.

DEMI-CANNON *loweſt,* the Name of a great Gun; (the ordinary ones are about 9 Inches bore, 5400lb. Weight; ſome 10, ſome 11 Foot long, and carry a Shot of 30 Pound Weight;) it carries point blank 156 Paces; its Charge of Powder is 14 Pound Weight. There are alſo two Sizes of Demi-Cannon above this, which are ſomething larger, as the

Demi-Cannon Ordinary, which is $6\frac{1}{6}$ Inches Bore, 12 Feet long, weighs 5600 Pounds; its Charge of Powder is 17 Pounds 8 Ounces, carries a Shot $6\frac{1}{2}$ Inches in Diameter, and whoſe Weight is 32 Pounds, and the Piece ſhoots point blank 162 Paces.

Demi-Cannon of the largeſt Size, is $6\frac{5}{8}$ Inches Bore, 12 Foot long, of 6000 Pounds of Weight; its Charge is 18 lb. of Powder, and the Piece ſhoots point blank 180 Paces.

DEMI-CROSS, is an Inſtrument uſed by the *Dutch* to take the Sun's Altitude, or that of a Star at Sea; but 'tis not uſed by us, but the Croſs-ſtaff or Fore-ſtaff ſupplies its Place. The Demi-croſs is of this Figure;



The Staff A G is graduated eaſily, being only a Line of whole Tangents, whoſe Radius is E B, the Length of the Croſs-piece or *Tranſum:* It hath three Vanes; a Horizon-Vane, as A; a Sight-Vane, as H; and the Shade-Vane, as E.

When the Vanes are on the Staff and Croſs-piece, to take the Sun's Altitude, hold the Inſtrument with the Tranſum as upright as you can, and looking through the Sight-Vane, as H, look for the Horizon through the Slit in the Horizon-Vane, and then ſlide the Croſs-piece or Tranſum to and fro, 'till you cauſe the Shade of the Vane at E to fall at the ſame Time upon the Slit of the Horizon-Vane alſo at A; then are the Degrees cut on the Staff by the Edge of the Croſs-piece, the Sun's Altitude required. But to take the Height of a Star, you muſt remove the Horizon-Vane A, and put it on the End G, and transfer the Sight-Vane H to A; then holding up the Inſtrument upright, as before, looking through the Sight-Vane, ſee for the Horizon through the Horizon-Vane, and for the Star by the Shade-Vane, ſliding the Tranſum to and fro, 'till the Horizon and Star are both ſeen by their reſpective Vanes, and then the Tranſum will cut the Degrees of the Star's Altitude on the Staff, allowing about 8 or 10 Minutes for your Height above the Level of the Water, as muſt be done in all ſuch Caſes.

DEMI-CULVERING, a Piece of Ordnance; the common ſort of them are $4\frac{1}{2}$ Bore, 2700lb. Weight, 10 Foot long, carries a Shot of 10 Pounds 11 Ounces, is charged with 7 Pounds 4 Ounces of Powder, and ſhoots point blank 175 Paces.

Demi-Culvering of the loweſt Size, is $4\frac{1}{4}$ Inches Bore, 10 Foot long, of 2000 lb. Weight; its Charge is 6 Pound 4 Ounces of Powder; it carries a Ball of 4 Inches Diameter, and of 9 Pound Weight, and its level range is 174 Paces.

Demi-Culvering of the elder Sort is $4\frac{5}{8}$ Inches Bore, 13 Foot long, and $\frac{1}{3}$ of 3000lb. Weight; its Charge of Powder is 8lb. and 8 Ounces, the Ball is 4 Inches $\frac{1}{2}$ Diameter, weighs 12 lb. 11 Ounces, and the point blank Shot 178 Paces.

DEMI-DISTANCE of *Polygons:* See *Polygons.*

DEMI-DITONE, a Note in Muſick, being the ſame with *Tierce Minor:* See *Monochord.*

DEMI-GORGE, in Fortification, is half the Gorge or Entrance into the Baſtion, not taken directly from Angle to Angle where the Baſtion joins to the Cortine, but from the Angle of the Flank to the Center of the Baſtion, or Angle the two Cortines would make, were they thus protracted to meet in the Baſtion.

DEMI-QUAVER, a Note in Muſick: See *Notes* and *Time.*

DEMISE, [in *Law*] is applied to an Eſtate either in Fee-ſimple, Fee-tail, or for Term of Life, and ſo it is commonly taken in many Writs: The King's Death is in Law termed *the Demiſe of the King.*

DEMOCRACY [δημοκρατεία of δῆμος the People, and κρατεῖν, *Gr.* to rule] is a Form of Government where the ſupreme Power and Authority is lodg'd in the People, and they chuſe all Adminiſtrators and Officers.

DEMONSTRATION, is a Chain of Arguments depending on one another, and founded primarily on firſt and ſelf-evident Principles, or plain Propoſitions eſtabliſhed and proved from them, and at laſt ending in the invincible Proof of the thing to be demonſtrated, as the Concluſion.

DEMURRER [in *Common Law*] ſignifies a kind of Pauſe upon a Point of Difficulty in any Action. In Chancery the Defendant demurrs to the Plaintiff's Bill, averring it to be defective in ſuch and ſuch a Point; and demands the Judgment of the Court thereupon, whether he ſhall be compell'd to make any further or other Anſwer thereunto, *&c.*

DENARII *de Caritate*, were the Pentecoſtals or Whitſun Farthings, being anciently cuſtomary Oblations made to the Cathedral Church at the Time of Pentecoſt, when the Pariſh Prieſts and their People uſed to go viſit the Mother Church. In proceſs of Time this voluntary Oblation came to be claimed as a ſettled Due, and was charged on the Pariſh Prieſt, and it is now annually paid to the Biſhop in ſome Dioceſes. *L.*

DENARIUS. See *Penny.*

DENEB, the ſame with *Cauda Lucida*, or *Lion's Tail*, a Star ſo called: Which ſee.

DENIZEN [in *Law*] ſignifies an Alien that is enfranchiſed by the King's Charter, and in all reſpects almoſt to do as the King's Native Subjects do, *viz.* to purchaſe and poſſeſs Lands, and to be capable of any Office or Dignity; yet it is ſhort of Naturalization, becauſe a Stranger naturalized may inherit Lands by Deſcent, which a Man made only a Denizen cannot.

DENOMINATIVES [in *Logick*] are ſuch Terms as take their Original and Name from others.

DENOMINATOR *of a Fraction*, is the Number below the Line, ſhewing the Nature and Quality of the Parts which any Integer is ſuppoſed to be divided into: Thus in $\frac{6}{8}$, 8 the Denominator ſhews you, that the Integer is ſuppoſed to be divided into 8 Parts or half Quarters; and the Numerator 6 ſhews, that you take 6 of ſuch Parts, *i. e.* three Quarters of the whole.

DENOMINATOR *of any Proportion*, is the Quotient ariſing from the Diviſion of the Antecedent by the Conſequent: Thus, 6 is the Denominator of the Proportion that 30 hath to 5, becauſe 5) 30 (6. This is alſo called the Exponent of the Proportion or Ratio.

DENSE, that Body is ſaid to be Denſe or Thick, when it hath more of Matter, in proportion to the Space or Room it takes up, than other Bodies have; and the being under theſe Circumſtances is called the

DENSITY [in *Phyſick*], is a Property or Habitude of Bodies, that is directly oppoſite to *Rarity*, whereby they contain ſuch a Quantity of Matter under ſuch a Bulk; accordingly, a Body that contains more Matter than another under the ſame Bulk, is ſaid to be *denſer* than the other.

Hence the Maſs being proportionate to the Gravity, a denſer Body is ſpecifically heavier than one that is more rare; and a Body that is ſpecifically heavier is more denſe, than one that is ſpecifically lighter.

The Denſities and Bulks of Bodies are the two great Points on which all Mechanicks or Laws of Motion turn. It is an Axiom, that all Bodies of the ſame Denſity do contain equal Maſſes under equal Bulks; if the Bulks of two Bodies are equal, their Denſities are as their Maſſes; and of conſequence, the Denſities of equal Bodies are as their Gravities. If two Bodies have the ſame Denſity, their Maſſes are as their Bulks; the Maſſes of two Bodies are in a Ratio compounded of their Denſities and Bulks, and of conſequence, their Gravities are of the ſame Ratio: And if their Maſſes or Gravities are equal, their Denſities are reciprocally as their Bulks. The Denſities of any two Bodies are in a Ratio compounded of the direct Ratio of their Maſſes, and the reciprocal one of their Bulks.

The Denſity of the Air is a Property that has found a great deal of Employment to Philoſophers ſince the Diſcovery of the *Torricellian* Experiment and the Air Pump. See *Condenſation.*

It has been demonſtrated, that the Air has every where the ſame Denſity, at the ſame Diſtance from the Centre, in the ſame Veſſel, or even in Veſſels which communicate with each other.

The Denſity of the Air always increaſes proportionally to the Compreſſion or compreſſing Powers.

And hence it is, that the lower Air is denſer than the upper; yet the Denſity of the lower Air is not proportional to the Weight of the Atmoſphere, by reaſon of Heat and Cold, which make remarkable Alterations as to Rarity and Denſity. When the Air is rendered denſer the Weight of Bodies that are therein are diminiſhed, and when it is rarer, the Weight of Bodies in it are increas'd, by this reaſon, that Bodies loſe more in heavier Mediums than they do in lighter.

And hence if the Denſity of the Air be ſenſibly altered, Bodies equally heavier in a lighter Air, will have their *Æquilibriums* taken away in a denſer Air, if their Specifick Gravity be conſiderably different, and the ſpecifically heavier will preponderate, and this is the Foundation of the Manoſcope, an Inſtrument for meaſuring the Alterations in the Denſity of the Air.

DENSITY *of Bodies*, as that which produces it, is called *Condenſation.*

The Denſity of Water to Air is, as Sir *Iſaac Newton* ſtates it, as 800, or 850 to 1, allowing the Mercury in the Baroſcope 30 Inches; though Mr. *Boyle* and ſome others make it as 1000 to 1; but I judge the former Proportion comes neareſt the Truth.

The Denſity of Quick-ſilver to Water is as $13\frac{1}{2}$ to 1; and when the Quick-ſilver is extraordinary good, as 24 to 1 nearly; and conſequently the Denſity of Quick-ſilver to Air is as 11617 to 1.

Sir *Iſaac Newton* aſſerts the Denſity of the Planets *Sol*, *Saturn*, *Jupiter*, and of our Earth, and the Moon, to be as 100, 60, 76, 387, and 700, and concludes the Sun to be a little denſer than *Jupiter*, and our Earth 7 times more denſe than the Sun.

DENTAL [*Dentalis*, *L.*] An Epithet given to thoſe Letters, in the Pronunciation of which the Teeth have a principal Share.

DENTARPAGA: See *Forfex.*

DENTED Verge [in *Botany*] apply'd to ſuch Leaves of Plants notched or jagged about the Edges, of which ſome are fine, others large, others deep.

DENTIDUCUM: See *Forfex.*

DENTRIFICE [*Dentrificium, L.*] Is a Medicine for the whitening, ſcouring, and faſtning the Teeth, and for ſtrengthning the Gums.

DENTILS, DENTICLES [in *Architecture*] is a Member of the *Ionic Cornice*, ſquare and cut out at convenient Diſtances, which gives it the Form of a Set of Teeth, and the Original of its Name.

DENTITION, is the Time that Children breed Teeth, which is about the ſeventh Month, or later; and uſually the upper Teeth come firſt, though in ſome the under; and amongſt theſe the Fore-Teeth firſt. *Blanchard.*

DEOBSTRUENT *Medicines*, Remedies that open Obſtructions.

DEODAND, a Thing devoted or conſecrated to God for the Pacification of his Wrath, in caſe of Miſadventure, whereby any Chriſtian Man cometh to a violent End, without the Fault of any reaſonable Creature; as if a Horſe ſhould ſtrike his Keeper, and ſo kill him; in this Caſe the Horſe is to be a Deodand, that is, given to God, that is, to be ſold, and diſtributed to the Poor, for an Expiation of that dreadful Event, though effected by an unreaſonable Creature.

DEOPILATIVE, the ſame with *Deobſtruent Medicines*: Which ſee.

DEPART, a certain Operation in Chymiſtry is called *the Depart*, becauſe the Particles of Silver are made by it to depart from Gold, when they were before melted together in the ſame Maſs, and could not be ſeparated any other way.

'Tis done by melting the united Metals together in a Crucible with a ſtrong Fire, and while the Matter is in Fuſion, caſting it into a Veſſel of cold Water, the Mixture will be divided into very ſmall Grains, which being collected again, and having *Aqua Fortis* poured on them, the *Menſtruum* will diſſolve the Silver, but leave the Gold at the Bottom in a Powder; which, after the Solution of the Silver is gently poured off, muſt be waſhed to ſweeten it. This is intended for a kind of Purification of Gold; but all the Particles of Silver will ſcarce be ſeparated from it even this way. The only way to purify Gold exactly, is by Antimony: Which ſee under *Purification*; if you would purſue this Depart farther, and get your Silver out of the *Aqua Fortis*; put then into an Earthen Pan a Plate of Copper, and on it pour 10 or 12 times as much Water as the Quantity of your impregnated *Aqua Fortis*; into which put in the *Menſtruum* of *Aqua Fortis*, and let the Mixture lie ſtill for ſome Hours, or till you find the Copper-Plate to be covered all about with the Powder or Precipitate of Silver, and that the Water begins to run blue; then filtrate the bluiſh Water, and this is that which is called *Aqua Secunda*. Dry the Powder of Silver, and melt it into an Ingot in a Crucible, with a little Salt Petre. If you ſteep a Plate of Iron ſome Hours in this *Aqua Secunda*, you will have another Depart; for the *Menſtruum* will let go the Copper which it had diſſolved, and which made it look blue, to prey upon the Iron, and you will have your Copper in Powder on the Iron-Plate: And if you filtrate this Diſſolution, you may get the Iron out of it, by laying in it a Piece of *Lapis Calaminaris*, the Iron will depart out and fall to the Bottom in a Powder, and the Stone will be diſſolved, or at leaſt as much of it as the *Menſtruum* can contain. If you again filtrate this Water, and then pour upon it drop by drop the *Liquor of fix'd Nitre*, the *Lapis Calaminaris* will be precipitated to the Bottom: And laſtly, if you filtrate this Water as before, and after having evaporated a Part of it, ſet the reſt in a cool Place, you will have Chryſtals of Salt Petre which will burn like the ordinary ſort. *Note*, That though the Silver, the Copper, and the Iron could not be gotten perfectly out of the *Menſtruum*, yet the Liquor of fix'd Nitre will precipitate all the *Lapis Calaminaris*, and the remaining Particles of the Silver, Copper and Iron.

DEPARTER, or *Departure* from a Plea or Matter, is where a Man pleads a Plea in bar of an Action, and being replied thereunto, doth in his Rejoinder ſhew another Matter contrary to his firſt Plea, that is called *a Departure from his Bar*: It is applied alſo to a Plaintiff, who in his Replication ſhews new Matter from his Declaration. So if a Man plead a general Agreement in Bar, and in his Rejoinder alledge a ſpecial one, this ſhall be adjudged a Departure in Pleading: So in Treſpaſs, if the Defendant will plead a Diſcent, and the Plaintiff replies, that after this Defendant infeoffed him; and the Defendant eſſoins that this Feoffment was upon Condition, for the Breach whereof he entred; this is a Departure, for it is new Matter.

DEPARTURE *in deſpight of the Court*, is when a Tenant or Defendant appears to an Action, and hath a Day over in the ſame Term, or is called after, though he had no Day given him, ſo that it be in the ſame Term: If he do not appear, but make Default, it is a Departure in deſpight of the Court, and therefore he ſhall be condemned.

DEPARTURE [in *Navigation*] is the Eaſting or Weſting of a Ship with reſpect to the Meridian it departed or ſail'd from: Or 'tis the Difference of Longitude (either Eaſt or Weſt) between the preſent Meridian the Ship is under, and that where the laſt Reckoning or Obſervation was made: This Departure, any where but under the Æquator, muſt be accounted according to the Number of Miles in a Degree proper to the Parallel the Ship is under. See *Mercator's Sailing*.

DEPHLEGMATED, *i. e.* cleared from its Phlegm or Water, is a Term uſed by the Chymiſts to expreſs that any Spirit is pure and unmix'd with Water or Phlegm, which to effect, they rectify it, as they call it, that is, diſtil it over again; and when 'tis fully deprived of all Water and Phlegm, or at leaſt as much of it as it can well be, they ſay ſuch a Spirit is well dephlegmated.

DEPILATORY, DEPILATIVE [*Depilatorius, L.*] an external Medicine that takes away the Hair from any Part of the Body.

DEPONENT [in *Grammar*] a Term apply'd to ſuch Verbs as have active Significations, but paſſive Terminations or Conjugations.

DEPOSITION, is the Teſtimony of a Witneſs ſet down in Writing by way of Anſwer to the Interrogatories exhibited in Chancery, where ſuch Witneſs is called a Deponent.

DEPOSITION, in the Senſe of the Grammarians, is the Termination of the Dimenſions of a Latin or Greek Verſe, ſo as to diſcover whether it be perfect, redundant or deficient; wherefore in this reſpect they reckon four kinds of Verſes; *Acatalectick*, where no Syllable is wanting at the End; *Catalectick*, where a Syllable is wanting at the End; *Brachycatalectick*, where a Foot is wanting at the End; and *Hypercatalectick*, where a Syllable or two are redundant, and this kind is called alſo *Hypermetros*.

DEPOSITUM [in the *Civil Law*] is a Contract of the Law of Nations, by which a Thing is committed to the Cuſtody of one to be kept, without

out any Reward, on Condition to be returned truly again on Demand. *L.*

DEPRESSION *of Equation:* See *Equation,* N° 3.

DEPRESSION *of the Pole*; ſo many Degrees as you ſail or travel from the Pole towards the Zenith, you are ſaid to depreſs the Pole, becauſe it becomes (reſpectively) as much lower or nearer to the Horizon.

DEPRESSOR, *vel Deprimens Auricularum,* a Muſcle of the Ear, in Beaſts ſerving to depreſs or let fall the Ear. *L.*

DEPRESSOR *Labii Inferioris:* It's difficult to determine whether this be one only, or two Muſcles, it lying between the *Depreſſores Labiorum Communes,* poſſeſſes that Part of the lower Jaw called the Chin, and aſcending with a direct and tranſverſe order of the Fibres, is inſerted into the nether Lip, in depreſſing of which it turns it outwards. *L.*

DEPRESSOR *Labiorum,* is a Muſcle that ariſes fleſhy from the lower Edge of the inferior Jaw Bone laterally, and aſcends directly to its *Interiores* at the Angle of the Lips: This, with its Partner and the *Quadrati* acting, expreſs a ſorrowful Countenance, in drawing down the Corners of the Mouth and Cheeks. *L.*

DEPRESSOR *Oculi,* is a Muſcle of the Eye which ariſes from the profoundeſt Part of the Orbit, and paſſes directly to its Inſertion to the oppoſite Part of the Globe of the Eye. *L.*

DEPRIMENS, or *Humilis,* one of the ſtraight Muſcles which move the Globe of the Eye; its Uſe is, to pull it downwards. *L.*

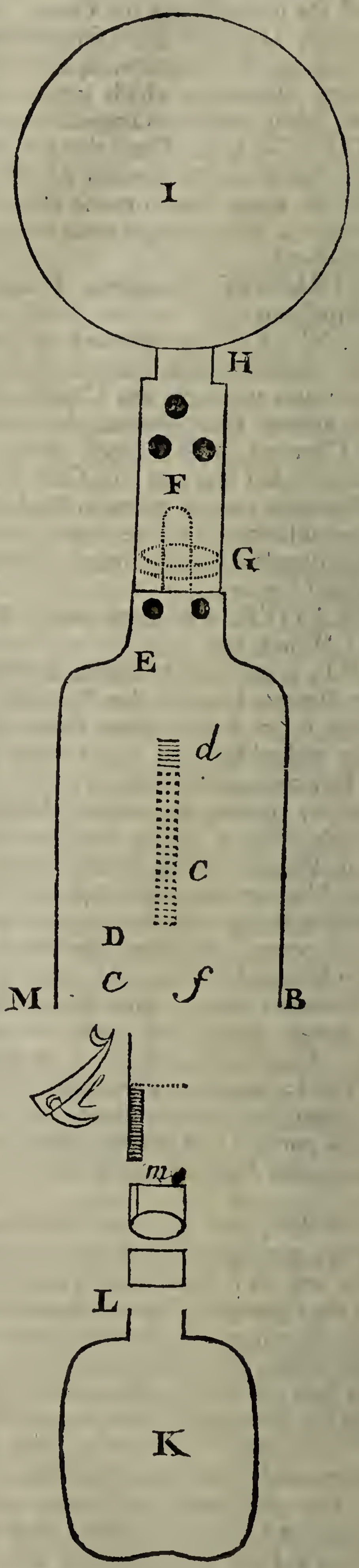
DEPRIVATION, is a bereaving or taking away; as when a Biſhop, Parſon, Vicar or Prebend is deprived or depoſed from his Preferment for any Matter in Fact or in Law; as if a Schiſmatick or meer Lay-man be preſented, admitted, inſtituted and inducted, this is good Cauſe of Deprivation.

DEPRIVATION of *a Benefice,* is when for ſome great Crime a Miniſter is wholly and for ever deprived of his Living or Preferment; and differs from Suſpenſion in this, that Suſpenſion is only a Temporary Deprivation. *L.*

DEPRIVATION *ab officio,* is when a Miniſter is for ever depriv'd of his Orders, which is the ſame in reality, with what is otherwiſe call'd Depoſition and Degradation.

DEPTH *of a Squadron* or *Battalion,* is the Number of Men that are in a File; which of a Squadron is three, and of a Battalion generally ſix; whence it comes that we ſay a Battalion is drawn up 5 deep, or 6 deep.

For Meaſuring the DEPTH *of the Sea.*



The Reverend Dr. *Deſaguliers,* and the Reverend Mr. *Stephen Hales* having contriv'd a Machine according to the Figure above repreſented for meaſuring the Depth in the Sea with great Expedition and Certainty, ſhew'd it to the Royal Society.

There have indeed been ſeveral Machines contriv'd for meaſuring the different Depths of the Sea, eſpecially ſuch as could not be determined by the Lead and Line, which Machines conſiſted of two Bodies (the one ſpecifically heavier, and the other ſpecifically lighter than the Water) ſo joined together, that as ſoon as the heavier came to the Bottom, the lighter ſhould get looſe from it and emerge; and the Depth was to be eſtimated by the Time of the Fall of the compound Body, from the Top to the Bottom of the Water, together with the Time of the Emerſion of the lighter Body, reckon'd from the diſappearing of the Machine, till the emergent Body was ſeen again; but no Conſequence can be drawn from ſo precarious and complex an Experiment.

For that the Time will hardly be the ſame in two Experiments, even in Still-Water, and in the ſame Place; and much leſs will this Machine anſwer in the Sea, by Reaſon of Waves and Currents, and many other Obſtructions.

But as the Preſſure of Fluids is always the ſame at the ſame Depth, in all Directions, a Gage that exactly diſcovers what the Preſſure is at the Bottom of the Sea, will ſhew what the true Depth of the Sea in that Place is, whether the Time of the Deſcent of the Machine be but a Minute or two, or twenty times as long.

The Reverend Mr. *Hales* has, in his *Vegetable Staticks*, deſcribed his Gage for eſtimating the Preſſures made in opaque Veſſels; where Honey being poured over the Surface of Mercury, as it is preſſed up into a Tube, the lower Orifice of which is immerſed into the Honey and Mercury, and the Top of which is ſealed Hermetically. Now, as the Air in the Tube is condenſed by the Preſſure, and the Mercury riſes; ſo the Mercury comes down again when the Preſſure is taken off, and would leave no Mark of the Height to which it had riſen; but the Honey (or Treacle, which does better) that is upon the Mercury ſticking to the Inſide of the Tube, leaves a Mark which ſhews the Height to which the Mercury had riſen, and of Conſequence makes appear what was the greateſt Preſſure.

Upon this, Dr. *Deſaguliers* contriv'd a Machine that will carry down Mr. *Hales*'s Gage to the Bottom of the Sea, and immediately bring it up again.

A B is the Gage-Bottle,

F *f* the Gage-Tube, which is cemented to the Braſs Cap of the Bottle at G, with its open End *f*, immerſed in the Mercury G; which, by the Preſſure of 32 Foot of Water, is carried up to *d*, with a little Treacle or Honey *d* upon it, raiſed up from D, a ſmall Thickneſs of Treacle poured on upon the Mercury.

When the Preſſure of Water is from a Depth of 64 Foot, the Mercury and Treacle riſe up to E ⅔ of the Height of the Tube, and ſo higher proportionably to the Depth.

N. B. A Scale may be mark'd on the Tube with a Diamond. K is a Weight which hangs by its Shank L, in a Socket *m*, fix'd to the Ring M B, cemented at the Bottom of the Bottle. When the whole L of the Shank is ſhov'd up to *m*, the Catch L of the Spring S holds it from falling out of the Socket while the Machine is deſcending; but as ſoon as K touches the Ground at the Bottom of the Sea, the Hole L riſing, the Catch flies back, and lets go the Weight, as appears in the Figure: Then the empty Glaſs Ball I (which, at Sea, may be a Hog's Bladder) riſes up to the Surface of the Water, with the Machine, in which, by obſerving how high the Inſide of the Tube is dawb'd, the Preſſure, and conſequently the Depth of the Sea, is known.

H G is a Braſs Tube to guard the Top of the Gage Tube, there are Holes at F G and E, to admit the Water to paſs freely every where.

To confirm the Uſe of this Sea-Gage, he made another Experiment in the following manner:

He poured ſome Quick-ſilver into the Bottom of the Gage, and afterwards poured Treacle upon it, to the Depth of Half an Inch, and then ſcrew'd on the Braſs Cap of the Bottle, to which the Glaſs-Gage Tube was cemented; by which means the open End of the Tube was brought under the Surface of the Mercury, the ſealed End being upwards.

Having thus fitted the Machine, he immerſed it in a Cylindrical Veſſel of Water, which was preſs'd between two Pillars, with a Plate at the Top, in ſuch a manner, that the Air might be condenſed over the Water, without eſcaping; then with a Syringe he forced in ſo much Air as to lay on a Preſſure equal to what would be in a Depth of 40 Foot of Water, and by opening the Cock of the upper Plate, let out the Air; and when the Machine was taken out, it appear'd how high the Quick-ſilver had riſen in the Gage-Tube, by the greaſy Mark that the Treacle had left within.

DEPURATION, is the cleanſing of any Body from its excrementitious Dregs, or more groſs Parts.

DERAIGNE, or *Dereigne* [in *Law*] ſignifies the Proof of a Thing which one denies to be done by himſelf, and the Adverſary affirms it, defeating and confounding the Aſſertion of his Adverſary, and ſhewing it to be without and againſt Reaſon or Probability.

DERELICKS [in the *Civil Law*] are ſuch as are wilfully thrown away and abandoned by the Owners.

DESCANT [in *Muſick*] ſignifies the Art of compoſing in ſeveral Parts, and is threefold, *viz.* Plain, Figurate, and Double.

Plain DESCANT, is the Ground-work or Foundation of Muſical Compoſition, and conſiſts altogether in the ordinary placing of many Concords.

Figurate or *Florid* DESCANT, is that wherein Diſcords are concerned, as well (tho' not ſo much) as Concords; and may well be termed, the Ornament or Rhetorical Part of Muſick, in regard that in this are introduced all the Varieties of Points, Figures, Syncopes, Diverſities of Meaſures, and whatſoever elſe is capable of adorning the Compoſition.

Double DESCANT, is when the Parts are ſo contrived, that the Treble may be made the Baſs; and on the contrary, the Baſs the Treble.

DESCENSION *Oblique.* See *Oblique Deſcenſion.*

DESCENSION *Right.* See *Right Deſcenſion.*

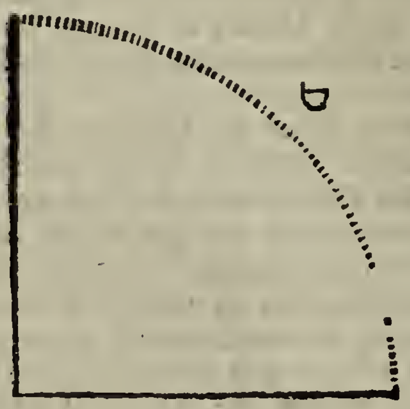
DESCEUSORIUM, a Chymical Furnace, in which Subſtances are diſtill'd by Deſcent, or downwards.

DESCENT [in *Law*]. See *Diſcent.*

DESCENTS [in *Fortification*] ſignify the Holes, Vaults, and Hollow-Places, made by undermining the Ground, as the Counter-ſcarp or Covert-way: So that a

DESCENT *into the Moat* or *Ditch*, is a deep digging into the Earth of the Covert-way, in Form of a Trench, of which the upper Part is covered with Madriers or Clays againſt Fires, to ſecure the Paſſage into the Moat.

DESCENT *of heavy Bodies.* If a Body deſcend from A by its proper Gravity, it will come to the Centre S in the ſame time as another ſuch like Body, by its Revolution, ſhall deſcribe the Quadrant A D E. *Princ. Phyſ. Math. Lib.* 1. *Prop.* 38. *Cor.* 1.



Wherefore, abſtracting from the Reſiſtance of the Medium, all Bodies muſt needs deſcend equally ſwift, and come to the Centre from the ſame Height, at the ſame time, as in Fact is found by Experiment true.

An heavy Body let fall from any Height near the Surface of our Earth, deſcends in a Second of Time $16\frac{11}{24}$ Feet *Engliſh*, or $197\frac{1}{2}$ Inches.

PROP. I.

The Velocities of deſcending heavy Bodies are proportionate to the Times, from the Beginning of their Falls.

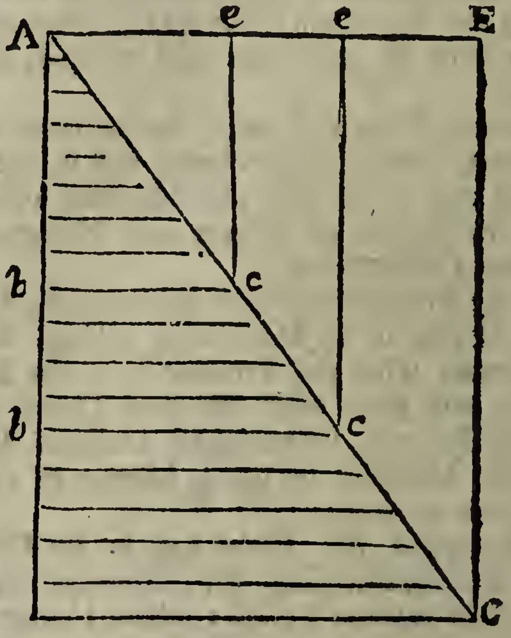
This follows (ſaith the Learned Capt. *Halley, Philoſoph. Tranſ.* N. 179.) becauſe the Action of Gravity being continual in every Space of Time, the following Body receives a new Impulſe, equal to what it had before, in the ſame Space of Time, received from the firſt Power; *v. gr.* in the firſt Second of Time a Body hath acquired a Velocity, which, in that Time, would carry it a certain Diſtance; ſuppoſe 32 Foot, 2 Inches, and there were no new Force, it would continue to deſcend at that Rate with an equable Motion: But in the next Second of Time, the ſame Power of Gravity continually acting thereon, ſuperadds a new Velocity equal to the former; ſo that at the End of two Seconds, the Velocity is double to what it was at the End of the Firſt: And after the ſame manner may it be proved to be triple at the End of the third Second; and ſo on: Wherefore the Velocities of falling Bodies are proportionate to the Times of their Falls. *Q. E. D.*

PROP. II.

The Spaces deſcribed by the Fall of a Body, are as the Squares of the Times from the Beginning of the Fall.

DEMONSTRATION.

Let A B repreſent the Time of the Fall of a Body B C, perpendicular to A B the Velocity acquired at the End of the Fall, and draw the Line A C; then divide the Line A B repreſenting the Time, into as many equal Parts as you pleaſe, as *b b b b, &c.* and from theſe Points draw the Lines, *b c, b c, &c.* parallel to B C; 'tis manifeſt, that the ſeveral Lines *b c*, repreſent the ſeveral Velocities of the falling Body, in ſuch Parts of the Time as A *b* is of A B: It is evident likewiſe, that the Area A B C is the Sum of all the Lines *b c* taken together; which, according to the Method of Indiviſibles, are infinitely many: So that the Area A B C repreſents the Sum of all the Velocities, between none and B C, ſuppoſed infinitely many; which Sum is the Space deſcended in the Time repreſented by A B. And by the ſame Reaſon, the Area's A *b c* will repreſent the Spaces deſcended in the Times A *b*; ſo that the Spaces deſcended in the Times A B, A *b*; are as the Area's of the Triangles A B C, A *b c*; which, by the 20th of the 6th of *Euclid*, are as the Squares of their homologous Sides, A B, A *b*; that is to ſay, the Times: Wherefore the Deſcents of falling Bodies are as the Squares of the Times of their Fall. *Q. E. D.*



PROP. III.

The Velocity which a deſcending Body acquires in any Space of Time, is double to that wherewith it would have moved the Space deſcended by an equable Motion in the ſame Time.

DEMONSTRATION.

Draw E C parallel to A B, and A B parallel to B C, and compleat the Parallelogram A B C E; it is evident, that the Area thereof may repreſent the Space, a Body moved equally with the Velocity B C would deſcribe in the Time A B; and the Triangle A B C repreſents the Space deſcribed by the Fall of a Body in the ſame time A B (by the foregoing Propoſition). Now the Triangle A B C is Half the Parallelogram A B C E, and conſequently the Space deſcribed by the Fall, is Half what would have been deſcribed by an equal Motion with the Velocity B C in the ſame time; wherefore the Velocity B C at the End of the Fall, is double to that Velocity which, in the Time A B, would have deſcribed the Space fallen, repreſented by the Triangle ABC, with an equable Motion. *Q. E. D.*

PROP. IV.

All Bodies, on or near the Surface of the Earth, in their Fall, deſcend ſo as at the End of the firſt Second of Time they have deſcribed Sixteen Feet, one Inch, London *Meaſure, and acquired the*

the Velocity of Thirty-two Feet, two Inches, in a Second.

This is made out from the 25th Propoſition of the 2d Part of Mr. *Huygens de Horologio Oſcillatorio*, wherein he demonſtrates the Time of the leaſt Vibrations of a Pendulum, to be to the Time of the Fall of a Body from the Height of Half the Length of the Pendulum, as the Circumference of a Circle to its Diameter; whence, as a Corollary, it follows, That as the Squares of the Diameter to the Square of the Circumference, ſo half the Length of the Pendulum vibrating Seconds to the Space deſcrib'd by the Fall of a Body in a Second of Time; and the Length of a Pendulum vibrating Seconds being found, 39, 125, or ⅛ Inches, the Deſcent in a Second will be found, by the aforeſaid Analogy, 16 Feet and one Inch; and by the laſt Propoſition, the Velocity will be double thereto; and near to this it hath been found by ſeveral Experiments, which, by Reaſon of the Swiftneſs of the Fall, cannot ſo exactly determine its Quantity.

From theſe Four Propoſitions, all Queſtions concerning the Perpendicular Deſcent of Bodies, are eaſily ſolved; and either Time, Height, or Velocity, being aſſigned, one may readily find the other Two.

From them likewiſe is the Doctrine of Projects deducible, aſſuming the two following Axioms, *viz.*

1. That a Body ſet a moving, will move on continually in a Right-line, with an equable Motion, unleſs ſome other Force or Impediment intervene, whereby it is accelerated, retarded, or deflected.

2. That a Body being agitated by two Motions at a Time, does, by their compounded Forces, paſs thro' the ſame Points as it would do, were the two Motions divided and acted ſucceſſively.

The Learned Mathematician, Mr. *Keil*, in his Examination of Dr. *Thomas Burnet*'s *Theory of the Earth*, P. 124. proves, That the Direction of heavy Bodies is not towards the Centre of the Earth any where but at the Equator, or at the Poles: However they will be all perpendicular to their Horizons, and ſo there can be no Error in levelling of Lines, and in finding the Riſings and Fallings of the Ground. And from hence (as he ſhews, P. 128.) 'tis plain, the Surface of the Earth cannot be exactly ſpherical, but the Earth's Equatorial Diameter to its Polar, is as 692 to 689.

DESCRIBENT, a Term [in *Geometry*] expreſſing ſome Line or Surface, which, by its Motion, produces a Plain Figure, or a Solid. See *Dirigent*.

DESCRIPTION, is a ſuperficial Imperfect, or inaccurate Definition of a Thing, giving a ſort of Knowledge thereof from ſome Accidents and Circumſtances peculiar to it, which determine it enough to give an Idea that may diſtinguiſh it from other things; but without explaining its Nature or Eſſence.

DESHACHE [in *Heraldry*] is when a Beaſt has its Limbs ſeparated from its Body, ſo that they ſtill remain on the Eſcutcheon, with only a ſmall Separation from their natural Places. *F.*

DESICCATION, is an Evaporation of ſuperfluous Moiſture by Heat.

DESICCATIVE *Medicines*, are the ſame with *Drying Medicines*.

DESIGN [in *Arts* or *Sciences*] is the Draught, *i. e.* the Thought, Plan, Geometrical Repreſentation, Diſtribution, and Conſtruction of a Painting, Poem, Building, *&c.*

DESIGN [in *Painting* or *Sculpture*] is the Expreſſion of the Images or Ideas that the Painter hath conceived in his Mind on the Picture, *&c.* and it is good, when the Author hath a good Guſto and correct Judgment: This is the Baſis and Foundation of all other Parts, and may be compared to the Stile of a correct Writer. But the Painters call Deſigns, chiefly, ſuch Draughts as they uſually expreſs on Paper, in order to the Performance of ſome conſiderable Piece of Work. A feint imperfect Deſign is uſually called a *Sketch*.

DESIGNING, the Art of delineating or drawing the Appearance of natural Objects, by Lines on a Plain.

DESIRE, is an Uneaſineſs in the Mind upon the Abſence of any thing, whoſe preſent Enjoyment carries the Idea of Delight with it; and is greater or leſs, as that Uneaſineſs is more or leſs vehement.

DE-SON *Tort Demeſne*, are Words of Form in an Action of Treſpaſs, uſed by way of Reply to the Plea of the Defendant. When the Defendant ſays, *He did what he did by the Command of his Maſter*; the Plaintiff replies, *That the Defendant did it* De Son Tort Demeſne, *viz.* of his own Wrong, *&c.*

DESPAIR, is the Thought of the Unattainableneſs of any Good, which works differently in Mens Minds, ſometimes producing Uneaſineſs or Pain, ſometimes Reſt and Indolency.

DESPOTICK is the ſame as abſolutely ſupreme, as when a Prince has gain'd ſuch an Abſolute and Deſpotick Power, that he will not be regulated by the Laws of his Country, but will govern only by his ſole Will and Pleaſure.

DESPOVILLE [in *Heraldry*] is the whole Caſe, Skin, or Slough of a Beaſt, with the Head, Feet, Tail, and all Appurtenances; ſo as being filled or ſtuffed, it looks like an entire Creature.

DESPUMATION is a Term in *Pharmacy*, and ſignifies the clearing and cleanſing of any Liquor, by letting it boil ſo as to take off the Scum.

DESQUAMATION [in *Surgery*] the cleanſing Curions Bones, which flake off like Scales.

DESSEIN [in *French*] ſignifies two things in Painting; either, in general, the Deſign or Thought that the Painter had about any great Piece, whether there be drawn only the Out-lines, or Contours; or whether he hath proceeded farther to put in the Shadows or the Colours; and if there appear much maſterly Skill or Judgment in the Thought or Deſign, we ſay, The Deſign was Great and Noble, *&c.*

It alſo ſignifies the juſt Meaſures, the Proportions and external Forms which thoſe Objects ought to have that are drawn in Imitation of Nature; and in this Senſe 'tis one of the Parts of Painting, and may be called a *juſt Imitation of Nature*.

DET, or *Debt*, is a Writ that lies where any Sum of Money is due to a Man, by Reaſon of Account, Bargain, Contract, or Obligation, or other Specialty, to be paid at a certain Day, which is not paid, then he ſhall have this Writ; but Action of Debt will not lie for Money due to a Lord by his Tenant for any Rent-Service, but he muſt diſtrain for it: So for Rent-charge or Rent-ſeck, which any Man hath for Life in Tail or in Fee, he ſhall not have any Action of Debt as long as the Rent continues, but his Executors may have an Action of Debt for the Arrearages due in the Lives of their Teſtator.

DETACHMENT, a Military Term, ſignifying a certain Number of Soldiers taken out of a greater Body, on Purpoſe to be employed in the Undertaking of ſome particular Enterprize; it is to form a kind a kind of flying Camp, to relieve a Party already engaged in Battle, to join a ſeparate Army, to aſſiſt at the Siege of a Place, to enter into ſome Garriſon, *&c.*

DETENTS [in a *Clock*] are thoſe Stops, which, by being lifted up, or let fall down, do lock and unlock the Clock in ſtriking.

DETENT *Wheel*, or *Hoop Wheel* [in a *Clock*] is that which has a Hoop almoſt round it, wherein there is a Vacancy, at which the Clock locks.

DETERGENT. See *Abſtergent.*

DETERMINED *Problem* [in *Geometry*] is that which hath but one, or but one certain Number of Solutions. This Problem hath but one only Solution, *viz. To deſcribe an Iſoſceles Triangle on a given Line, whoſe Angles at the Baſe ſhall be double to that at the Vertex.* But this following hath two Solutions: *To find an Iſoſceles Triangle, whoſe Area and Perimeter are given.*

A determined Problem may be either Simple or Linear, Plain, Solid, or Surſolid. Which ſee.

DETERRATION, is a Removal of the Earth, Sand, *&c.* from the Mountains and higher Grounds, down into the Valleys and lower Parts. This is occaſioned by Rains, which waſh the Earthy Matter down by Degrees; but this cannot be very conſiderable, or much raiſe the Surface of the Earth, as ſome have imagined, becauſe a good Part of it is ſunk into the Clefts and Caverns of the Rocks and Mountains, a great Quantity is born down into Rivers, and thence into the Sea, and the richer and finer Part helps to compoſe the Bodies of Plants and Vegetables.

DETERSIVE *Medicines*, are ſuch as are uſed to cleanſe the Body from ſluggiſh, viſcous, and glutinous Humours.

DETINUE, is a Writ that lieth againſt him who having Goods or Chattels delivered him to keep, refuſeth to deliver them again; and he taketh his Action of Detinue that intendeth to recover the Thing delivered, and not the Damages ſuſtained by the Detinue.

DETONATION, is a Chymical Word, expreſſing the thundering Noiſe that is often made by a Mixture, being enkindled in the containing Veſſel; for the volatile Parts do fly out with great Velocity and Impetuoſity. 'Tis the ſame with *Fulmination. L.*

DETRANCHE [in *Heraldry*] ſignifies a Line bend-wiſe, that does not come from the very Angle, but rather from ſome Part of the upper Edge, and thence falling athwart, or diagonally, or from Part of the Dexter Side.

DETRUSOR-URINÆ, is a Muſcle which is, by ſome, reckoned the firſt proper Membrane of the Bladder, lying under that which is derived from the Peritoneum; its carnous Fibres embracing the whole Bladder like a Hand (as *Spigelius* repreſents it) compreſſes it in the Evacuation of the Urine. *L.*

DEVASTAVERUNT *bona teſtatoris*, is a Writ lying againſt Executors for paying Legacies and Debts without Speciality, before the Debts upon the ſaid Specialities be due, to the Prejudice of Creditors. *L.*

DEVENERUNT, is a Writ directed to the Eſcheator, when any of the King's Tenants holding *in Capite*, dies; and when his Son and Heir within Age, and in the King's Cuſtody, dies, then ſhall this Writ go forth, commanding the Eſcheator, that by the Oaths of Twelve good and lawful Men, he enquire what Lands or Tenements, by the Death of the Tenant, come to the King.

DEVIATION [in the *Old Aſtronomy*] a Motion of the Deferent or Eccentrick, whereby it advances to, or recedes from the Ecliptick.

DEVISE, or *Diviſe* [in *Common Law*] is, when a Man, in his Will, bequeathes his Lands or Goods to another after his Deceaſe; and he to whom the Lands or Goods are bequeathed, is called, *The Deviſe.*

DEVISE [probably of *Dividere, L.* to divide] is a Name common to all Figures, Cyphers, Characters, Rebus's, Motto's, Sentences, Proverbs, *&c.* which, by Alluſion to the Names of Perſons or Families, denote their Nobility or Qualities.

In a more reſtrained Senſe, it is an Emblem or Repreſentation of ſome natural Body, with a Motto or Sentence applied, in a Figurative Senſe, to the Advantage of ſome Perſon.

A *Deviſe* is a ſort of Metaphor, which repreſents one Object by another, to which it bears ſome Reſemblance; ſo that a *Deviſe* is only true when it bears a metaphorical Similitude, and may itſelf be reduced into a Compariſon; or it may be defined, a painted and viſible Metaphor, that ſtrikes the Eye.

Others define it to be, a Compoſition or Aſſemblage of Figures drawn from Nature and Art, called the *Body*, and a few Words adapted to the Figure, and called the *Soul.*

DEVOLUTION [in *Law*] a Right acquired by Succeſſion, from one Degree to another.

DEVOURING. If any Fiſhes are borne in an Eſcutcheon in a feeding Poſture, the Herald's Term for it is *Devouring*, becauſe Fiſh ſwallow all their Meat whole.

DEUTEROPATHIA [of δευτερος, *Second*, and παθος, *Gr. Paſſion* or *Affection*] is a Diſeaſe that proceeds from another Diſeaſe: For Example, as the Head-Ach from the Diſtemper of another Part, the Morbifick Matter being tranſlated thither from its former Repoſitories. *Blanch.*

DEW is compoſed of Steams of the Terreſtrial Globe, which, for a while, ſwim to and fro in the Air, but at laſt convene into Drops, and then fall down again to the Earth.

DEW *of Vitriol*, ſo ſome Chymiſts will call a kind of Phlegm which is drawn from Vitriol in *Balneo Mariæ*, or with a gentle Heat.

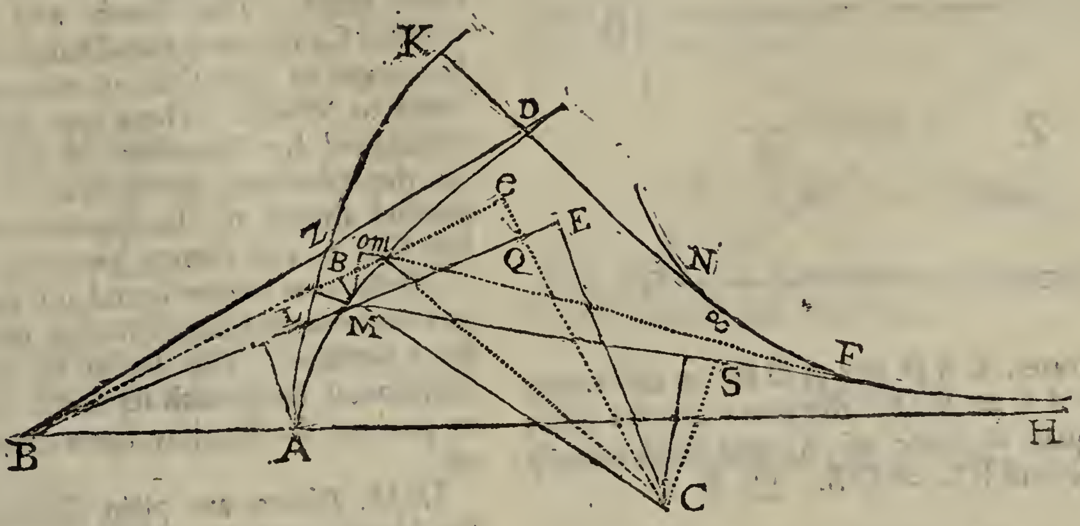
DEXTER *Side* or *Point*, is the Right Side or Point in an Eſcutcheon. See *Eſcutcheon.*

DIABETES [of διαβαίνω, *Gr.* to paſs, to paſs quick] ſo *Galen* calls it, and *Agineta Dipſacus*, from the great Thirſt that attends it; and as others will have it, from a certain ſort of Serpent called *Dipſacus*, found eſpecially in *Libya*, which poiſons with its Bite, and brings an unquenchable Thirſt upon the Perſon affected. The Diſeaſe is too great a Fuſion of the Blood, whereupon the Serum paſſes the Reins, and is voided in great Quantities by the Paſſages of the Urine. *Blanch.*

DIABETES [in *Hydraulicks*] is applied to a Syphon, the two Legs or Branches whereof are incloſed in one another; as the Glaſs deſcrib'd by *Hero*, which runs itſelf quite empty, without being inverted, as ſoon as the Water is arrived at the Height of the upper Branch of the Syphon.

DIABROSIS, is a Solution of the *Continuum* by Corroſion of the Parts. *Blanch.*

DIACAUSTICK *Curve*, or the *Cauſtick by Refraction.* If you imagine an infinite Number of Rays, B A, B M, B D, *&c.* iſſuing from the ſame Luminary Point B, to be refracted from or to the Perpendicular M C, at the Curve A M D; and ſo that C E, the Sines of the Angles of Incidence CME, be always to CG, the Sines of the refracted Angles C M G, in a given Ratio; then the Curve-



Line H F N, which touches all the refracted Rays, is called the *Diacauſtick*, or *Cauſtick by Refraction.* How to find theſe Cauſticks by Refraction to all ſorts of Curves, ſee *Hayes's Fluxions, p.* 243, *&c.* where alſo the Doctrine of the Foci of ſpherical Glaſſes of all ſorts, expoſed either to diverging, converging, or parallel Rays, is deduced from the Principles of the Cauſtick Curves. See *p.* 249. Of the Relation of this Diacauſtick Curve to the Evoluta, ſee *A Diſcourſe of Mr.* Jam. Barnoulli, *in the* Leipſick *Acts of* May, 1693.

DIACENTROS [of διὰ and κεντρον, *Gr.* a Centre] is a Word uſed by *Kepler*, to ſignify the ſhorteſt Diameter of the Elliptical Orbit of any Planet.

DIACLYSMA [of διακλύσμα, *Gr.*] is a waſhing of the Mouth to cleanſe it, or to ſtrengthen the Teeth or Gums. *Blanch.*

DIACOPRÆGIA, a Medicine of Goat's Dung, and uſed againſt Tumours in the Spleen and Glandules behind the Ears, called *Parotides. Blanch.*

DIACOUSTICKS [of διακουστικὰ of διὰ and ἀκέω, *Gr.* to hear] or *Diaphonicks*, is the Conſideration of the Properties of refracted Sound, as it paſſes through different Mediums.

DIACRISIS [διακρισις, of δια and κρίνω, *Gr.* to diſtinguiſh] is a Diſtinction and Dijudication of Diſeaſes and Symptoms. *Blanch.*

DIADOCHE [of διάδοχη, *Gr.*] is ſucceeding by a Criſis. *Blanch.*

DIADROME [of διαδρομὴ, *Gr.*] the ſame with the Vibration, or Motion, or Swing, of a Pendulum.

DIÆRESIS [in *Anatomy*] is the eating out, or conſuming of the Veſſels of an Animal Body, when, from ſome cutting corroding Cauſe, ſome Ways and Paſſages are made, which naturally ought not to have been; or when ſome which really are, yet are dilated more than ordinary, ſo that the Humours which ought to have been contained in the Veſſels, run out. *Blanch.*

DIÆRESIS [in *Grammar*] is the Diviſion of one Syllable into two, as in this Verſe of *Tibullus*, *Stamina non ulli diſſolüenda Deo*, for *Diſſolvendo.* This

DIÆRESIS is uſually noted by two Points placed over a Letter, to ſhew that it is ſounded by itſelf, and not joined with any other, ſo as to make a Diphthong; as *Aëra*, by the Points over the *e*, is diſtinguiſhed from *Æra*. 'Tis alſo a kind of *Metaplaſm* or Addition to a Word, by dividing one Syllable into two, as *Aulaï*, by a *Diæreſis*, is of three Syllables, inſtead of *Aulæ*.

DIÆRESIS [in *Surgery*] an Operation, ſerving to divide and ſeparate the Parts, when the Continuity is a Hindrance to the Cure.

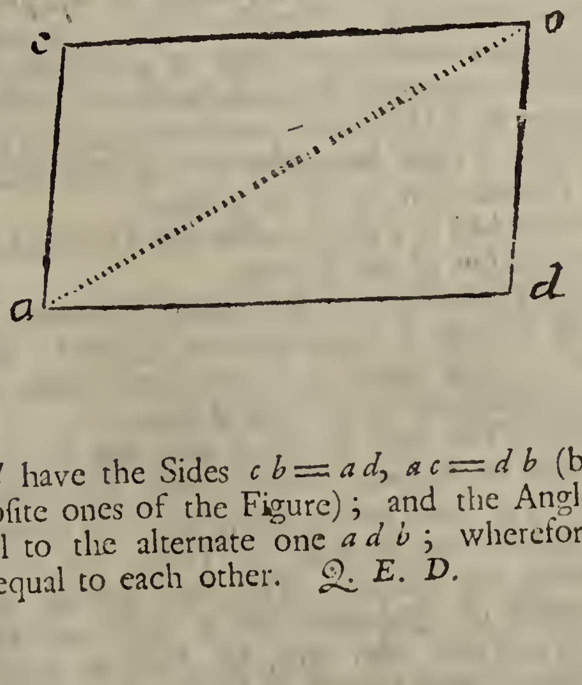
DIÆTETICA [διαιτητικὴ, of διαιτὰω, *Gr.* to preſcribe a Diet] is a Part of Phyſick that preſcribes the Uſe and Knowledge of the Six Non-natural Things, as the Phyſicians ſpeak.

DIAGLYPHICE [διαγλυφικὴ, of διὰ and γλύφω, *Gr.* to carve or engrave] is the Art of Cutting, or otherwiſe making hollow or concave Figures in Metals; ſuch as Seals and Intaglias's.

DIAGONAL [in *Geometry*] is a Line drawn acroſs from Angle to Angle in any Figure, and is by ſome called the *Diameter*; as in this Figure, *a b* is called a *Diagonal.*

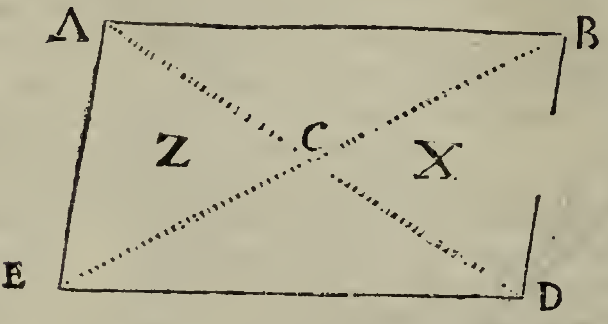
Propoſitions.

1. Every Diagonal divides a Parallelogram into two equal Parts; for the two Triangles, *a c b* and

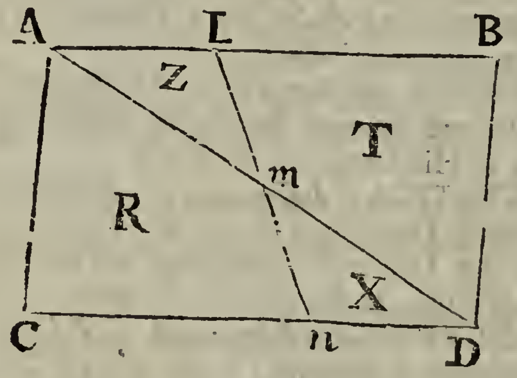


a b d have the Sides $cb = ad$, $ac = db$ (becauſe oppoſite ones of the Figure); and the Angle *c a b* equal to the alternate one *a d b*; wherefore they are equal to each other. *Q. E. D.*

2. Two Diagonals, AD and BE, being drawn in any Parallelogram, do biſect each other: I ſay, $AC = CD$, and $BC = CE$; for in the Triangles Z and X, the Vertical Angles at C are equal, and the alternate ones, EAD and ADB, are alſo equal, and the Side $AE = BD$; therefore all the Sides of Z are equal to thoſe of X, and conſequently $AC = CD$, and $EC = CB$. *Q. E. D.*



3. A Line (as LN) paſſing through the middle Point (m) of the Diagonal of a Parallelogram (AD) divides the Figure into two equal Parts: I ſay, $Z + R = T + X$; for $Z + T = R + X$ (becauſe of the Diagonal) and the Triangle $Z =$ Triangle X, as having the Vertical Angles at M, and the alternate ones, DAB and ADC, and alſo the Side AM and MD, all reſpectively equal to each other; therefore the remaining Trapezium R, when the Triangle Z is taken away, muſt be equal to T, when X is taken away; but if R be equal to T, and $Z = X$, then $Z + R$ muſt be euual to $X + T$, and each will be equal to half the Parallelogram. *Q. E. D.*



DIAGONAL *Scale.* See *Scale.*

DIAGNOSTICKS [διαγνωϛικὰ of διαγινώσκω, *Gr.* to know well] a Term in Medicine, are the preſent Signs whereby to judge of a Diſeaſe, or a Knowledge whereby Men underſtand the preſent Condition of a Diſtemper; and they make it threefold, either a right Judgment of the Part affected, of the Diſeaſe itſelf, or of its Cauſe.

DIAGRAM is a Scheme for the Deſignation or Demonſtration of any Figure.

DIAGRYDIUM, or *Diacrydium,* Scamony prepared by boiling it in a hollowed Quince; ſome prepare it with Juice of Quince, and others with Juice of Lemons, or of pale Roſes.

DIAL. The firſt Sun-Dial that was ſet up in *Rome,* was by *Papyrius Curſor,* about the Year of the City 447 (and before that there is no Mention, ſaith *Pliny,* of any Account of Time, but of the Sun Setting and Riſing). This Dial was ſet up in the Temple of *Quirinus,* but it went not right. About 30 Years after this, M. *Valerius Meſſala,* (ſays *Varro*) being Conſul, brought out of *Sicily,* from the taking of *Catana,* another Dial, which he ſet up on a Pillar near the Roſtrum; but for want of its being made for that particular Latitude, it could not go true: Nevertheleſs they made uſe of it 11 Years, and then *Martius Philippus,* who was Cenſor with *L. Paulus,* ſet up another that was more exact. The *Greeks* alſo were a long time without Clocks and Sun-Dials. Some attribute the Invention of Sun-Dials to *Anaximenes Mileſius,* and ſome to *Thales.* There are many kinds of Dials mentioned by *Vitruvius,* as one invented by *Beroſus* the *Chaldean,* which was on a reclining Plane, parallel almoſt to the Equinoctial; on this was an half Circle, and thence 'twas called *Hemicyclus.*

Ariſtarchus Samius found out the *Hemiſphere Dial,* and there were ſome Spherical ones, with a Needle for a *Gnomon.* The *Diſcus* of *Ariſtarchus* was an Horizontal Dial, with its Limb raiſed up all round to prevent the Shadow from extending itſelf too far off.

DIAL *Plains,* are plain Superficies upon which the Hour-Lines are drawn in any Latitude, and may be diſtinguiſhed into Parallel, Perpendicular, and Oblique, according to their Poſition with reſpect to the Horizon of the Place where they are made.

Parallel Plains or *Dials* are ſuch as lie level with the *Horizon,* and on that Account termed *Horizontal Dials.*

Perpendicular Plains are ſuch as ſtand erect to the *Horizon,* and ſuch are all thoſe that are ſet againſt an upright Wall or Building; which are of two ſorts, *viz.* either *Direct* or *Declining*; and theſe are often called *Mural Dials.*

Erect, Direct South, Weſt, North, Eaſt Plains, are thoſe Walls or Plains which face any one of the four Cardinal Points of the Horizon, and the Dials made upon ſuch a Plain, are called *Erect, Direct, South, Weſt, North, Eaſt Dials.*

Erect $\left\{\begin{array}{l}\textit{South,}\\ \textit{North,}\end{array}\right\}$ *Plains declining Eaſt* or *Weſt.* are thoſe Plains which lie open to any Two of the Cardinal Points, as to the $\left\{\begin{array}{l}\textit{South,}\\ \textit{North,}\end{array}\right\}$ and *Eaſt,* or to the $\left\{\begin{array}{l}\textit{South,}\\ \textit{North,}\end{array}\right\}$ and *Weſt.*

Oblique Plains, reclining from the *Zenith,* or inclining to the *Horizon,* are alſo of two ſorts; *viz.* either *Direct Reclining,* or *Declining* and *Reclining.*

Direct South, Weſt, North, or *Eaſt Recliners,* are thoſe *Reclining Plains* which lie open to any one of the Cardinal Points of the Horizon.

Reclining $\left\{\begin{array}{l}\textit{South,}\\ \textit{North,}\end{array}\right\}$ *Plains declining Eaſt* or *Weſt,* are thoſe Plains which face any two of the Cardinal Points $\left\{\begin{array}{l}\textit{South,}\\ \textit{North,}\end{array}\right\}$ and *Eaſt,* or to the $\left\{\begin{array}{l}\textit{South,}\\ \textit{North,}\end{array}\right\}$ and *Weſt.*

DIALECT is the peculiar Manner of *Idiom,* Spelling and Pronunciation of any Language in particular Places of the Nation. Thus among the *Greeks* the *Ionick* and *Dorick* Way of Speaking and Writeing was different from the *Athenian,* which therefore are called the Dialects of the *Greek* Language; and ſo it is in all Countries.

DIALECTICAL *Arguments* [in *Logick*] are ſuch as are barely probable, but do not convince or determine the Mind to either Side of the Queſtion; tho' ſome will have Dialecticks to be the ſame as the Art of true Reaſoning in general, and to be as comprehenſive as univerſal Logick.

DIALEMMA, the ſame with *Apyrexia.*

DIALLING. Some Authors on this Subject, are :

J. Bapt. Benedicti, de Re Gnomonica.
Kercheri, Ars magna Lucis & Umbræ. Rom. 1646.
Marignani Perſpectiva Horaria.
Leybourn's Dialling.
Colling's Geometrical Dialling.
Cir. Clavii Gnomonices, Libri 8. *Fol.*
Voellus de Scioterícis Horologiis.
Cæſtii Horologiographia Plana.
Hollwell's Dialling, 4*to.*
Fr. Comondini de Horologio Deſcriptione, 4*to.*
Sargue's Univerſal Way of Dialling.
Foſter's Elliptical Horologiography.
Fale's Art of Dialling.
Well's Art of Shadows, 8*vo.*

The principal Problems in Dialling, are ſuch as relate to find the Hour Diſtances, and other Requiſites of a Sun-Dial. We ſhall begin by the laſt, as being neceſſary to be known, in order to calculate the Hour-Diſtances.

1. *For an Horizontal Dial.*

In this there is nothing required but the *Height of the Stile above the Plane*, and that is always equal to the Latitude of the Place.

2. *Direct, Vertical, North, or South Planes.*

In theſe Planes alſo, there is nothing required but the *Height of the Stile above the Plain*, and that is always equal to the Complement of the Latitude of the Place.

3. *Vertical Declining Planes.*

In theſe Planes, before the Hour-Diſtances can be calculated, three things, beſides the Latitude of the Place and Declination of the Plane, muſt be found; of which in their Order, &c.

Problem 1.

To find the Stile's Height.

Say, as R : Co-S. Lat. Place : : Co-S. Decl. Plain : S. Stile's Height.

Problem 2.

To find the Subſtile's Diſtance from the Meridian.

Say, as R : S. Decl. Plane : : Co-tan. Lat. Place : Tan. Diſtance of the Subſtile from the Meridian.

Problem 3.

To find the Plane's Difference of Longitude.

Say, as Co-S. Lat. Place : R : : S. Subſtile's Diſtance from the Meridian : S. Plane's Difference of Longitude, or Diſtance from a South or North Plane.

4. *Eaſt or Weſt Reclining or Inclining Planes.*

In theſe Planes, as in the Vertical Decliners, three things, beſides the Latitude and Reclination, muſt be found, before the Hour-Diſtances can be calculated; and they are the ſame as in the other; of which in their Order.

Problem 1.

To find the Stile's Height.

Say, as R : S. Lat. Place : : S. Reclination : S. Stile's Height above the Plane.

Problem 2.

To find the Subſtile's Diſtance from the Meridian.

Say, as R : Co — S. Reclination : : Tan. Lat. Place : Tan. Subſtile's Diſtance from the Meridian.

Problem 3.

To find the Plane's Difference of Longitude.

Say, as S. Lat. Place : R : : S. Subſtiles Diſt. from the Meridian : S. Plane's Difference of Longitude.

5. *South Declining* $\left\{\begin{matrix}\textit{Reclining}\\ \textit{Inclining}\end{matrix}\right\}$ *Planes.*

In theſe Planes, beſides the St.-Pl. the Decl. and Reclination, or Inclination of the Plain, four things muſt be found, before the Hours can be drawn; of which in Order. And,

Problem 1.

To find the Diſtance of the Meridian and Horizon.

Say, as Radius : S. Reclination or Inclination : : T. Decl. T. Diſt. of the Meridian and Horizon.

Problem 2.

To find the Stile's Height.

Say, as R : S. Diſt. Meridian and Horizon : : Co-S. Reclination, or Inclination S. a 4th Arch; which ſubtracted from the Lt.-Pl. leaves a 5th Arch; then ſay, as S. Diſt. Meridian and Horizon : S. Stile's Diſt. from the Meridian.

Problem 3.

To find the Subſtile's Diſtance from the Meridian.

Say, as Co-t. Decl.-Pln. T. Stile's Height : : that 4th S. (in the preceeding *Probl.*) : S. Subſtile's Diſtance from the Meridian.

Problem 4.

To find the Plane's X *Lng.*

Say, as the 5th S. (found in the foregoing *Prob.*2.) R : : S. Subſtile's Diſtance from the Meridian : S. Plain's X Lng.

6. *North Declining* $\left\{\begin{array}{l}\textit{Reclining}\\\textit{Inclining}\end{array}\right\}$ *Planes.*

In theſe Planes (as in South Decliners Reclining) the ſame four things muſt be found, before the Hour-Diſtances can be obtained; of which in Order. And,

Problem 1.

To find the Diſtance of the Meridian and Horizon.

Say, as R : S : Reclination or Inclination : : T. Decl.-Pln : Co-T. Diſt. Meridian and Horizon.

Problem 2.

To find the Stile's Height.

Say, as S. Decl.-Pln : R : : Co-S. Diſt. Meridian and Horizon : S. a 4th Arch, to which add the Compl. Lt.-Pl. then the Compl. of that Sum to 180, ſhall be a 5th Arch : Then ſay, as S. 4th Arch : S : 5th : : S. Reclination : S. Stile's Height.

Problem 3.

To find the Subſtile's Diſtance from the Meridian.

Say, as T. Reclination : Co-S. Diſt. Meridian and Horizon : : T. Stile's Height : S. a 4th Arch, or its Complement, to 180 Deg. is the Subſtile's Diſt. from the Meridian, according as you count from the North or South.

Problem 4.

To find the Plane's X *Lng.*

Say, as S. Stile's Height : R : : T. Diſt. Subſtile and Meridian : Co-T. a 4th Arch, which Arch is the Plain's X Lng. from the North, or its Complement to 150 Deg. if you account it from the South.

7. *Direct South and North Reclining Planes.*

In theſe Planes there is nothing required before the Hour Diſtances be calculated, but the *Stile's Height*, which may eaſily be found, thus:

1. *For South Recliners.*

If the Reclination be $\left\{\begin{array}{l}\text{leſs}\\\text{more}\end{array}\right\}$ than the Comp. L.t-Pl. than the $\left\{\begin{array}{l}\text{X}\\\text{Z}\end{array}\right\}$ of the Reclination and Compl. Lt.-Pl. is the Stile's Height.

2. *For the North Recliners.*

Add the Reclination to the Compl. Lt.-Pl. and their Sum (if leſs than 90 Deg.) or its Complement to 180 Deg. (if more than 90 Deg.) is the Stile's Height.

8. *To calculate the Hour-Diſtances upon all ſorts of Planes.*

Upon all Horizontal, and upon all direct North and South Planes, whether Erect or Reclining, the Stile ſtands upon the 12 o'Clock Line; for theſe Planes have X Lng. and therefore the Subſtile and Hour-Line of 12 are the ſame, and the Equinoctial Diſtances of each Hour from 12, is 15 Degrees.

In all other Planes (as Erect Decliners, and North and South Recliners declining) which have X Lng. the Planes X Lng. muſt be reduced into Time, by allowing 15 Degrees for one Hour; *i. e.* one Deg. for 4 Min. of Time; and ſo having found the Equinoctial Diſtances of the Hours on either Side of the Subſtile, the Equinoctial Diſtances for all the other Hours are eaſily found, by the continual Addition of 15 Deg. for an Hour; and then the Propoſition will be,

As R : S. Stile's Height above any Plane whatſoever, it be : : T. of the Equinoctial Diſtance of any Hours from the Meridian of any Direct North or South Plane, whether Erect or Reclining : — But from the Subſtile of all other Planes : to the T. of the true Hour Diſt. upon the Plane, from the Meridian, or Subſtile.

DIALLING *Globe*, is an Inſtrument made of Braſs or Wood, with a Plane fitted to the Horizon; and an Index particularly contrived to draw all ſorts of Dials, and to give a clear Demonſtration of that Art.

DIALLING *Sphere*, is an Inſtrument made of Braſs, with ſeveral Semicircles ſliding over one another on a moving Horizon, to demonſtrate the Nature of the Doctrine of Spherical Triangles, and to give the true Idea of drawing Dials on all manner of Planes. See more in *Dial.*

DIALLING [in a *Mine*] which they call alſo *Plumming*, is uſing a Compaſs (which they call a *Dial*) and a long Line, to know which way the Load or Vein of Oar inclines, or where to ſink an Air-ſhaft, or to bring an Adit to a deſired Place. See the manner of it under the Word *Tin.*

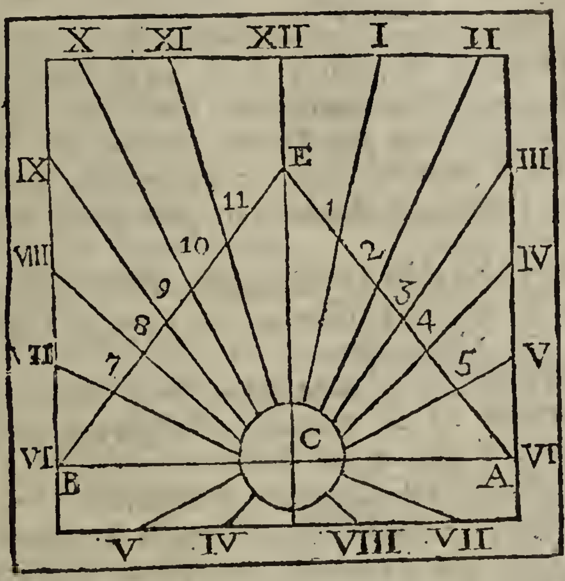
DIALLING *Lines* or *Scales*, are ſuch graduated Lines, as, being placed on Rulers, or the Edges of Quadrants, and other ſuch-like Inſtruments, are deſigned to expedite the Conſtitution of all kind of Dials.

Theſe Lines are :

1. *A Scale of Six Hours*; which is only a double Tangent, or two Lines of Tangents, each of 45 Deg. ſet together in the Middle, and equal to the whole Line of Sines, with the Declinations ſet againſt the Meridian Altitudes, in the Latitude of *London*, ſuppoſe, or whatever Place elſe it is made for. The Radius of which Line of Sines, is equal to the Dialling-Scale of Six Hours.

2. *A Line of Latitudes*; which is fitted to the Hour-Scale, and is made by this Canon: *As Rad.* : *to the Chord of* 90 *Deg.* : : *So are the Tangents of each reſpective Degree of the Line of Latitudes, to the Tangents of other Arks.* And then the natural Sines of thoſe Arks are the Numbers; which taken from a Diagonal Scale of equal Parts, ſhall graduate the Diviſions of the Line of Latitudes, to any Radius.

The Line of Hours and Latitudes is general for pricking down all Dials with Centres: As ſuppoſe: 1. An Horizontal Dial for the Latitude of *London*, 51 Deg. 30 Min. draw C E for the Hour-line of 12, and croſs it at Right-angles with A B. Then out of the Scales of Latitudes ſet off C B and C A each equal to 51 Deg. 30 Min. or the Stile's Height. Then take the whole Scale of Six Hours, and ſet it from A to E, and from B to E, dividing thoſe two Lines A E and B E, with the Compaſſes accordingly; as you ſee in the Figure:



Then Lines drawn from C the Centre of the Dial, thro' thoſe Points: 1, 2, 3, 4, 5, and 11, 10, 9, 8, 7, *&c.* ſhall be the true Hour-Lines. And this is a very ready and eaſy way to deſcribe the Hour-Lines on any Plane. See *Collins*'s *Sector on a Quadrant.*

The other Scales are particular, and give the ſeveral Requiſites for all upright declining Dials by Inſpection.

They are theſe:

3. A Line of Chords.
4. A Line for the Subſtile's Diſtance from the Meridian.
5. A Line for the Stile's Height.
6. A Line of the Angle of 12 and 6.
7. A Line of Inclination of Meridians.

When theſe are placed altogether on a Ruler, in order as they ſhould be:

Count the Plane's Declination in the Line of Chords, and then a Square laid over it will interſect all the other Lines in their proper Points: Or you may open the Compaſſes to the Plane's Declivation in the Chords, and then that Diſtance will find all the reſt in the other Scales. Thus, ſuppoſe a Plane decline 35 Deg. from the Meridian, then all the Requiſites, by theſe Scales, will be found thus:

	Deg.	*Min.*
The Subſtile's Diſtance from the Meridian — — —	24	30
The Stile's Height — —	30	38
The Inclination of Meridians —	41	49
The Angle of 12 and 6 —	84	10

All which previous Requiſites being found, the Dial may be drawn eaſily and readily, by applying in the Hour-Scale, by the Help of the Line of Latitudes, and the Subſtilar-Line, as *Collins* ſhews how to do in his Sector on a Quadrant, *p.* 268; or by any other Method of deſcribing Hour-Lines on a given Plane.

DIAMETER [διάμετρ℗, of διὰ and μέτρον, *Gr.* Meaſure] is a Line that paſſes thro' the Middle of any Figure, from one Corner to another; and this ſhould rather be called the *Diagonal.*

DIAMETER *of a Circle*, is a Right-line which paſſes thro' the Centre of a Circle, and is terminated at each End by the Circumference dividing the Circle into two equal Parts.

DIAMETER *of a Conick Section*, is a Right-line drawn thro' the Middle of the Figure, and biſecting all the Ordinates; and if it biſect them at Right-angles, 'tis called the *Axis of the Section*, and often the *Ax.*

DIAMETER *Conjugate* [in the *Ellipſis*] is the ſhorteſt Axis or Diameter.

DIAMETER *Conjugate* [in the *Hyperbola*] is a Line drawn parallel to the Ordinates, and through the Centre or Middle-point of the Tranſverſe Axis, and is always a Middle-proportional between the *Latus Rectum* and the *Latus Tranſverſum.*

DIAMETER *of Gravity* in any Surface, Body, or Solid, is that Right-line in which the Centre of Gravity is placed.

DIAMETRICALLY *Oppoſite*, is when Two Things are oppoſed to one another, right acroſs, or directly contrary, as one End of a Diameter is to another.

DIANA's *Tree.* Diſſolve an Ounce of Silver in three Ounces of Spirit of Nitre, then pour the Diſſolution into a Matraſs, in which before you had put 18 or 20 Ounces of Water, and two Ounces of Quick-ſilver: The Glaſs muſt be filled up to the Neck; and all muſt lie ſtill on a Round of Straw, in ſome cool Place, for 40 Days together, during which Time the Tree will begin to ſpread forth its Branches, and will have little Balls at the End, which will repreſent Fruit.

Another, like a Firr-Tree, may be thus made: Diſſolve an Ounce of Coppel-Silver in 3 Ounces of *Aqua-fortis*; ſet the Glaſs in Sand, and evaporate about half the Moiſture; after which, add to the Remainder three Ounces of good diſtilled Vinegar; let it be a little hot, and keep it ſtirring; then put the Matraſs into a little cool Place, for about a Month, and then the Tree will riſe up to the very Top of the Liquor.

To recover the Silver again in both theſe Experiments: In the former, take the whole Matter and ſhake it together, and then boil it for about Half an Hour in an Earthen Veſſel; then let it cool 'till 'tis juſt no more than luke-warm, and pour upon it gently, a Quart of Water, in which you had before diſſolved two Ounces of Salt; a white Precipitate will fall down, which gather and dry; put it into a Retort in a Sand-Furnace, fitting it to a Receiver filled with Water, and beginning with a ſmall Fire at firſt, increaſe it till the Retort is red-hot. The Quick-ſilver will diſtill, Drop by Drop, into the Receiver; continue the Fire till no more will come; you will find the Mercury in the Bottom of the Receiver, which waſh and dry with a Linnen-Cloth and Crumbs of Bread. The Silver will remain in the Retort, which may be recovered into pure Silver, by melting the Matter in a Crucible, with a little *Salt-Petre.*

In the latter Experiment to get the Silver again, you need only pour Salt-Water upon the whole ſhaked together, which will precipitate a white Powder, and that Powder melted in a Crucible, with a little *Borax* or *Salt-Petre*, will run into fine Silver. Becauſe this way of making *Diana*'s Tree is very tedious, Mr. *Homberg* hath given us, in the *Memoirs Mathemat. & de Phyſique*, *A. D.* 1692. *P.* 146. The following Method of making this curious Experiment in leſs than a Quarter of an Hour's Time.

Take four Drams of Filings of fine Silver, with which make an Amalgam, without Heat, with two Drams of Quick-ſilver; then diſſolve this Amalgam in 4 Ounces of *Aqua Fortis:* Pour this Solution into 12 *Paris* Pints of common Water (which is about 3 Gallons. *Engliſh*) ſtir it about a while to mingle it well together, and then keep it in a Glaſs Veſſel well ſtopped.

When you would make the Experiment, take about an Ounce of it and put it in a ſmall Viol, wherein put alſo about the Quantity of a ſmall Pea of the ordinary *Amalgama* of Gold or Silver, which ſhould be as ſoft as Butter, and ſet the Viol at reſt for about two or three Minutes; preſently after which you will ſee ſeveral ſmall Threads or Filaments ariſing perpendicularly from the little Bulb of the newly put in *Amalgama;* and which will ſenſibly grow, and thruſt out on the Sides ſmall Branches in the Form of a Tree. The Bulb or Ball of the *Amalgama* will grow hard, and be like a Pellet of white Earth, but the little Tree will be of the Colour of bright Silver.

Only obſerve, that the Water which ſerves once for this Experiment, will not ſerve a ſecond time.

Mr. *Homberg* ſaith, you may vary the Form of this Metalline Tree almoſt as you pleaſe: The ſtronger you make the firſt deſcribed Water, the thicker will the little Tree be in Branches, and the ſooner formed; but if that be weak, the Branches will be ſparing, ſlender, and ſlow in growing: And afterwards he ſhews how ſeveral other kinds of Trees may be formed alſo by Chryſtallization and by Digeſtion.

DIAPASMA [διάπασμα, *Gr.*] according to *Pliny*, is a dry Medicine made up of dry Powders, to be ſprinkled upon ſomething, as either upon Cloaths to perfume them, or upon Ulcers or Wounds ſeveral ways, or upon Drink to make it more delicious. *Blanchard.*

DIAPASON, [διάπασον, *Gr.*] a Greek Word, ſignifying a Chord including all Tones; 'tis the ſame with what we call an Eighth or an Octave, becauſe there are but ſeven Tones or Notes, and then the Eighth is the ſame again with the firſt. *Ariſtotle* ſays, it was not called *Dioctò*, as it ſhould have been, becauſe the ancient Harp, which had all the Tones then known, had but 7 Strings, the Terms whereof are as 2 to 1.

DIAPASONDIAEX [in *Muſick*] a kind of compound Concord, of which there are two Sorts; the greater; which is in the Proportion of 10 to 3, and the leſs, which is in that of 16 to 5.

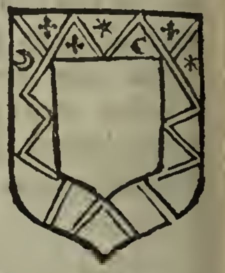
DIAPASONDIAPENTE [in *Muſick*] is a compound Conſonance in the triple Ratio, or as 3 to 9, it is a Symphony made when the Voice proceeds from the firſt to the 12th Tone.

DIAPASON DIATESSARON [in *Muſick*] a compound Concord, founded on the Proportion of 8 to 3. This is a Symphony when the Voice proceeds from its firſt Tone to the eleventh.

DIAPASON DITONE [in *Muſick*] a Concord whoſe Terms are in the Proportion of 12 to 5.

DIAPEDESIS [διαπήδησις, *Gr.*] is an Eruption of the Blood by reaſon of the Thinneſs of the Veſſels. *Blanchard.*

DIAPENTE [διαπέντε, *Gr.*] an Interval of Muſick, whoſe Terms are as 3 to 2, it being the ſecond of the Concords, and makes an Octave with the *Diateſſeron*; it is otherwiſe called a perfect Fifth.



DIAPER [in *Heraldry*] ſignifies a Bordure fretted all over with ſome ſuch things as Bordures uſed to be charged with, all appearing between the Frets; a Bearing which hath been uſed in ſome *French* and *Belgick* Coats of Arms.

DIAPHANEITY [of διαφανὴς, *Gr.* tranſparent] is the Property of ſuch a Body as is *Diaphanous*, which is one that is tranſparent like Glaſs, the Humours of the Eyes, the *Tunica Cornea*, &c. And ſuch a Body hath its Pores ſo ranged and diſpoſed, that the Beams of Light can paſs freely through them every way.

DIAPHANOUS [of διαφαίνω, *Gr.*] tranſparent or pellucid, giving Paſſage to the Rays of Light, as Water, Air, Glaſs, &c.

DIAPHORESIS [διαφόρησις, *Gr.*] Sweating, is a Perſpiration of all manner of *Effluvia* through the inviſible Pores of the Body.

DIAPHORETICKS: See *Sudorificks.*

DIAPHRAGMATICK *Artery*, is by ſome ſaid to iſſue from the Trunk of the *Aorta*, and thence to go to the *Diaphragma.*

DIAPHRAGM, διάφραγμα, of διαφράγνυμαι, *Gr.* to hedge about or defend.] by ſome called *Septum Tranſverſum* and *Diſeptum:* The Midriff, is a Muſcle compoſed of two others, which divide the Middle from the lower Cavity; the firſt and ſuperior Muſcle ariſes from the *Sternum*, and the Ends of the laſt Ribs on each ſide. Its Fibres from this Semi-circular Origination, tend towards their Center, and terminate in a Tendon or *Aponeuroſis*, which hath always been taken for the Nervous Part of the Diaphragm. The ſecond and inferior Muſcle comes from the *Vertebræ* of the Loins by two Productions, of which that on the right hand comes from the firſt, ſecond and third *Vertebræ.* That on the left Side is ſomething ſhorter, and both theſe Productions join and make the lower Part of the Midriff, which joins its Tendon with the Tendon of the other, ſo as that they make but one Membrane, or rather Partition.

The Diaphragm is covered with a Membrane from the *Pleura* on its upper ſide, and by the *Peritoneum* on its lower; it is pierced in the Middle to make a Paſſage for the *Vena Cava*, and in its lower Part, for the *Oeſophagus*, and for the Nerves which go to the upper Orifice of the Stomach. And again, between the Production of the inferior Muſcle, paſſes the *Aorta*, the *Ductus Thoraccius*, and the *Vena Azygos.*

The Diaphragm receives Veins and Arteries called *Phrenicæ* from the *Cava* and *Aorta*, and ſometimes on its lower Part two Branches from the *Vena Adipoſa*, and two Arteries from the *Lumbares.* It hath two Nerves which come from the third *Vertebræ* of the Neck, which paſs through the Cavity of the *Thorax*, and are diſperſed in the Muſcles of the Diaphragm.

In its natural Situation the Diaphragm is Convex on the upper ſide towards the Breaſt, and Concave on its lower one towards the Belly: Therefore when its Fibres ſwell and contract, it muſt become plain on each ſide, and conſequently the Cavity of the Breaſt is enlarged to give Liberty to the Lungs to receive the Air in Inſpiration; and at the ſame time the Stomach and Guts are preſt for the Diſtribution of the Chyle But it diminiſhes the Cavity of the Breaſt, when it reſumes its natural Situation, and preſſes the Lungs for the Expulſion of the Air in Expiration.

Diaphragm is alſo uſed by the Learned for all Partitions or Separations between two Parts of a Thing, as the ſmall perforated Partitions in the Tubes of long Teleſcopes.

DIAPHRATTONTES, are the Membranes called the *Pleura*, which cover the Inſide of the *Thorax*, and leave a kind of Partition in the Middle, called *Mediaſtinum*. *Blanchard.*

DIAPHTHORA, is a Corruption of any Part of the Body.

DIAPLASIS [διάπλασις, of διαπλάσω, *Gr.* to put together] is the Setting of a Limb which was out of Joint.

DIAPLASMA [of διαπλάσω, *Gr.*] is an Ointment, or Fomentation.

DIAPNOE [διαπνοὴ, *Gr.*] the ſame with *Diaphoreſis*.

DIAPYEMA, the ſame with *Empyema*.

DIAPYETICA, are Medicines which ripen and concoct purulent Matter.

DIARIA *Febris*, the ſame with *Ephemera*.

DIARRHOEA [διαῤῥοια, of διὰ through, and ῥέω, *Gr.* to flow] is a Looſeneſs in the Belly which ejects ſeveral Bilious, Pituitous, and other Feculent Excrements.

DIARTHROSIS διαρθρωσις, of διαρθρόω] is a good Conſtitution of the Bones, whereby they are apt to move eaſily and ſtrongly; ſuch as is in the Arm, Hand, Thigh, Foot, *&c.*

DIARTHROSIS, *Synarthrodialis*, a kind of neutral or dubious Articulation, being neither abſolutely *Diarthroſis*, as not having a manifeſt Motion; nor abſolutely *Synarthroſis*, as not being abſolutely immoveable.

DIASTEM [in *Muſick*] a ſimple Interval in Contradiſtinction to a compound Interval, which the Ancients call'd a Syſtem.

DIASTOLE, *Gr.* to diſtinguiſh by Joints, is the Dilatation or Expanſion of the Heart, when the Blood flows into it, from the Place where it is as it were accended, the Lungs.

Diaſtole [διαστολὴ, of δια and στελλω to contract] is alſo an Accent in Grammar, which ſhews that thoſe Words or Sentences to which it is adjoined, are to be ſeparated, and is marked thus (,) 'Tis alſo the making long a Syllable which is naturally ſhort.

DIASTREMMA [of διαστρέφω, *Gr.* to turn aſide] a Diſtorſion or Luxation.

DIASTYLE [διάστυλος, *Gr.*] is a ſort of Edifice, where the Pillars ſtand at ſuch a Diſtance one from another, that three Diameters of their Thickneſs are allow'd for Intercolumniation.

DIASYRMIS [in *Rhetorick*] a kind of Hyperbole, or an Exaggeration of ſome low ridiculous Thing.

DIATASIS [διάτασις, of διατείνω, *Gr.* to ſtretch out] a Diſtention of any ſort, particularly of a Limb in caſe of a Fracture.

DIATESSARON [of διὰ and τέσσαρες, *Gr.* four] a Word uſed in Muſick, ſignifying an Interval compoſed of one greater Tone, one leſſer, and one greater Semi-Tone; its Proportion being as 4 to 3. In Muſical Compoſition 'tis called a perfect Fourth.

DIATHESIS [διάθεσις, *Gr.*] is the Natural or Præternatural Diſpoſition of the Body, whereby we are inclined to perform all Natural Actions ill or well. *Blanchard.*

DIATONIC [of διατονος, *Gr.*] a Term which ſignifies the ordinary ſort of Muſick which proceeds by different Tones, either in aſcending or deſcending; it contains only the two greater and leſſer Tones, and the greater Semi-tone.

DIAZEUTICK *Tone*, in the Ancient Greek Muſick, was that which disjoin'd two Fourths, one on each Side of it, and which being join'd to either, made a fifth, This was in their Muſick that from *Meſe* to *Parameſe*; that is, in our Muſick, from A to B, ſuppoſing *Mi* to ſtand in *Bfabmi*, which is accounted its natural Poſition. They allowed to this Diazeutick Tone, which is our *La*, *Mi*, the Proportion of 9 to 8, as being the unalterable Difference of *Diapente* and *Diateſſeron*, or of the fifth and fourth.

DICHOTOMY [διχοτομία, *Gr.*] a Term uſed by Aſtronomers for that *Phaſis* or Appearance of the Moon, wherein ſhe is biſſected, or ſhews juſt half her Disk.

DICHOPHYIA] of διχα double, and φύω to grow, *Gr.*] is a Fault in the Hair, when it parts and disjoins too much. *Blanchard.*

DICHORÆUS, is the Foot of a Latin Verſe conſiſting of four Syllables, of which the firſt is long, the next ſhort, the third long, and the laſt ſhort. 'Tis compounded of two *Choræus*, as *Comprobare*.

DICROTUS [δίκροτος, *Gr.*] is a Pulſe that beats twice.

DIDYMI [δίδυμοι, *Gr.*] are Twins.

DIEM *clauſit extremum*, is a Writ that lieth for the Heir of him that holdeth Land of the King, either by Knight-Service or Soccage, and dieth, be he under or at full Age, directed to the Eſcheator of the County, to enquire of what Eſtate the Party died ſeized, and who is next Heir to him, and of what Value the Land is. *L.*

DIES CRITICI: See *Critici Dies*. *L.*

DIES-DATUS, a Term in Law, ſignifying a Reſpite given to the Tenant or Defendant by the Court. *L.*

DIESIS [δίεσις, *Gr.*] in Muſick, is the Diviſion of a Tone below a Semi-tone, or an Interval compoſed of a leſſer or imperfect Semi-tone; ſo that when Semi-tones are placed where there ought to be Tones, or when a Tone is ſet where there ſhould be only a Semi-tone, this is called Dieſis.

Enharmonical Dieſis, is the Difference between the Greater and the Leſſer Semi-tone.

Theſe Dieſes are the leaſt ſenſible Diviſions of a Tone, and are mark'd on the Score in Form of St. *Andrew*'s Croſs.

DIEU SON ACT, are Words uſed in our Law, and it is a Maxim, that the Act of God ſhall prejudice no Man; and therefore if a Houſe be beaten down by Tempeſt, or other Act of God, the Leſſee for Life or Years ſhall not only be quit in an Action of Waſte brought againſt him, but hath by the Law a ſpecial Intereſt to take Timber to build the Houſe again, if he will, for his Habitation. So when the Condition of an Obligation conſiſts in two Parts, in the Disjunctive, and both are poſſible at the Time of the Obligation made, and afterwards one of them becomes impoſſible by the Act of God, the Obligor is not bound to perform the other part, for the Condition ſhall be taken beneficially for him.

DIFFERENCE [in *Logick*] ſignifies an eſſential Attribute belonging to any Species that is not found in the *Genus*, and is the Univerſal Idea of that Species; thus Body and Spirit are two Species of Subſtance, which do contain in their Ideas ſomething more than is in that of Subſtance; in Body we firſt find Impenetrability, and Extenſion; in a Spirit a Power of Thinking and Reaſoning; ſo that the Difference of Body is impenetrable Extenſion, and the Difference of a Spirit is Cogitation.

DIFFERENCE [in *Mathematicks*] is the Remainder when one Number or Quantity is ſubtracted from another.

DIFFERENCE *of Aſcenſion:* See *Aſcenſional Difference.*

DIFFERENCE *of Longitudes*, of two Places on the Earth, is an Arch of the Equator, comprehended between the Meridians of thoſe two Places,

DIFFERENCES in a Coat of Arms; ſo the Heralds call ſuch Things as diſtinguiſh one Family from another, or Perſons of the ſame Family from each other. They are by *Guillim* accounted either Ancient or Modern: The Ancient ones are the *File* or *Label*, *Creſcent*, *Mullet*, *Martlet*, *&c.*

DIFFORM, is a Word uſed in Oppoſition to *Uniform*, and ſignifies that there is no manner of Regularity in the Form or Appearance of a Thing. The Botaniſts uſe it as a Diſtinction of the Flowers of Plants. See *Flower.*

DIFFUSION, is uſually taken to ſignify the diſperſing of the ſubtile *Effluvia* of Bodies into a kind of Atmoſphere all around them; thus the Light diffuſed by the Rays of the Sun, iſſuing all round from that amazing Body of Fire, and thus are the Magnetical Particles diffuſed every where round about our Earth in Parts adjacent to it.

DIGASTRICUS or *Biventer*, is a double bellied Muſcle (whence its Name) which ariſes from the Proceſs called *Mammiformis* or *Maſtoides*, whence deſcending it becomes Tendinous, paſſing through the *Stylohyoideus*, and an Annular Ligament faſtned to the *Os Hyoides*; from which Bone ſome Tendinous Fibres do ariſe, and join with its ſecond fleſhy Belly, aſcending from thence to its Inſertion at the Middle of the inferior Part of the lower Jaw. The middle Tendon of this Muſcle, and its Partner, paſſing through two annular Ligaments, fix'd to the *Os Hyoides*, as Ropes through a double Pulley, is a wonderful Contrivance of the Author of Nature to render them capable of pulling the lower Jaw down, which had their Progreſs been direct from their Originations, that could not have been performed. Nor are there any Proceſſes, whether of the *Vertebræ* of the Neck, or the neighbouring Parts, that could give an Origination to thoſe Muſcles below their Inſertion, as in ſome Quadrupeds; wherefore the Divine Architect of Human Bodies has placed this double Pulley below their Terminations, whereby they perform their deſigned Office. Hence Deglutition is hindred when theſe Muſcles are in Action, they then preventing the Aſcent of the Tongue and *Larynx*; neither can we at that Time draw the lower Jaw down, becauſe the Center of Direction is pulled upwards; wherefore we are obliged on that Occaſion to keep the Jaws cloſe together. But in Dogs and other voracious Animals, who have theſe Muſcles ariſing from the Tranſverſe Proceſſes of the firſt *Vertebræ* of the Neck, theſe Actions are not dependant; whence it is they devour their Aliment ſo quick.

DIGEST or *Pandects*; the 1ſt Volume or Tome of the Civil Law is called *Digeſts*, or *Pandects*: *Digeſts*, becauſe the Author hath put, or digeſted all things, every Book and Title in its proper and natural Place and Order; and *Pandects* from πᾶν and δέχομαι, as containing and comprehending in itſelf all that ever *Juſtinian* drew or collected out of 150,000 Verſes of the old Books of the Law.

This Digeſt was collected from the Works of 27 Venerable and Eminent Old Lawyers, whereof ſeveral were before Chriſt, and the Others flouriſh'd in the Time of the Emperors, even unto the Time of *Maximinus*, as we find from *Spartianus* and *Lampridius* in that Emperor's Life. The Tome o the Digeſts is divided into 7 Parts, and they again into 50 Books. To this Tome Sir *Thomas Ridley* adds the Inſtitutions or Inſtitutes; which ſee under that Word.

DIGESTER, a Veſſel ſo called by its Inventor Mr. *Papin*, and is a kind of *Balneum Mariæ Clauſum.*

DIGESTIO *Chymica*, a *Chymical Digeſtion*, is when things are digeſted by an Artificial Heat, juſt as they are naturally in the Stomach, which is when ſome Matter is put over a gentle Heat, to infuſe it in ſome poper *Menſtruum* or Liquor fit to diſſolve it, that ſo it may, as near as can be, be like the Effect of Natural Heat.

DIGESTION, the Concoction of the Aliments, or the Diſſolution of them, by which they are turned into Chyle.

Mr. *Charles Leigh*, then of *Brazen-Noſe College* in *Oxon*, has a Diſcourſe concerning Digeſtion, publiſhed in *Phil. Tranſ. N.* 162. wherein he ſuppoſes that there is neceſſary to Digeſtion in the Stomachs of Animals, 1. A Liquid Menſtruum, which by its peculiar Faculty operates upon their Meat, and helps to diſſolve it. 2. A gentle Heat in the Stomach; which he thinks it receives from the Liver, and therein falls in with the Opinion of Dr. *Gliſſon*. 3. 'Tis neceſſary that the Stomach have a Natural Situation. 4. That the *Omentum* be aſſiſting; for it hath been found by Anatomy, that where the *Omentum* hath been putrified in an Human Body, it was always accompanied with a bad Digeſtion and loſs of Appetite; and 'tis alſo obſervable, that thoſe Creatures which have no *Omentum*, as Hares and Conies, *&c.* do help their Concoction by doubling their hinder Legs, and reſting their Bellies upon them. 4. 'Tis neceſſary that the Stomach would have a *Tunica Villoſa*, which both helps to divide the Meat into ſmall Parcels, and alſo keeps the *Tunica Carnoſa* from being too much diſtended, which would by degrees weaken and injure its Tone. 5. 'Tis neceſſary that the Guts ſhould lie in a winding Poſition, and be of a good length; for otherwiſe the Meat digeſted in the Stomach would paſs away too faſt.

The firſt of theſe, the Liquid Menſtruum or Natural Ferment of the Stomach, he thinks conſiſts of theſe Ingredients; 1. The *Saliva* or Spittle. 2. The Juice contained in the Stomachical Glands. And, 3. The Nitro-aerial Spirit of the Nerves.

DIGESTIVE *Medicines*, are either Internal or External.

The Internal are uſually preſcribed to prepare the Body by Purgation, which they do by making the Humours fluid, attenuating and drawing viſcous or tough Subſtances, tempering ſuch as are ſharp, diluting Salts, blunting, concentrating, and imbibing Acids, *&c.*

External Digeſtives, are ſuch as ripen a Tumor, or generate good and laudable Matter in a Wound

DIGIT [in *Aſtronomy*] is the twelfth Part of the Diameter of the Sun or Moon; 'tis uſed to exexpreſs the Quantity of an Eclipſe.

DIGIT is taken from *Digitus*, *L.* a Finger, and is properly ¾ of an Inch, or contains the Meaſure of four Grains of Barley laid breadth-wiſe.

DIGITATUM *Folium*, among the Botaniſts is the Term for the Leaf of the Plant, which either is compoſed of many ſimple Leaves ſet together upon one Foot-ſtalk, as in Cinque-foil, Vetches, *&c.* or elſe when there are many deep Gaſhes or Cuts in the Leaf, as in thoſe of Straw-berries, Hops; *&c.*

DIGITORUM *Tenſor*: See *Extenſor Digitorum Communis.* L.

DIGITS, or *Monades*, a Term in Arithmetick, ſignifying any Integer under Ten, as, 1, 2, 3, 4, 5, 6, 7, 8, 9.

DIGLYPH [*δίγλυφ*, *Gr.*] a kind of imperfect Triglyph, Conſole, or the like, with only two Channels or Engravings.

DIHELIOS [in the *Elliptical Aſtronomy*] a Name given by *Kepler* to that Ordinate of the Ellipſis, which paſſes through the *Focus*, wherein the Sun is ſuppoſed to be placed. *Kepler.*

DIJAMBUS is the Foot of a *Latin* Verſe of four Syllables, and compounded of two *Iambicks*, ſo that the firſt and laſt are ſhort, and the two middle long, as *Severitas.*

DILAPIDATION, is a waſteful deſtroying, or letting of Buildings run to Ruin and Decay for want of Reparation, 13 *Eliz. c.* 13. And the Money recover'd for Dilapidations, by 14 *Eliz. c.* 11. ſhall be employ'd in the Repair of the ſame Houſes. *L.*

DILATATION [among the *Anatomiſts*] is when any Paſſages or Receptacles in the Body are too much ſtretch'd or diſtended; and, in general, it ſignifies a Thing's taking up more Space than it did before. *L.*

DILATORIUM is a Chirurgeon's Inſtrument wherewith the Mouth is dilated or opened: It is called likewiſe *Speculum Oris*, becauſe by it one may ſee into the Mouth.

DILATORES *Alarum Naſi*, are ſmall thin Muſcles, having a double Order of Fibres decuſſating each other, not unlike the *Muſculi Intercoſtales*; they pull up the *Alæ*, and dilate the Noſtrils. *L.*

DILEMMA is an Argument compounded uſually of four or more Propoſitions, and ſo diſpoſed, that own or grant which you will of them, yet ſtill the Argument ſhall preſs you, and hem you in with Difficulties not readily to be ſolved or ſurmounted, eſpecially if the Dilemma be juſt; in order to which, the Diviſion and Enumeration of the Parts muſt be adequate and entire; your Antagoniſt muſt be truly preſſed and affected with one or more of the Propoſitions; and the *Arguer* himſelf free from a Poſſibility of having the Dilemma returned upon him.

DILUTE [*Dilutus*, *L.*] is a Word frequently uſed by the Writers of Chymiſtry and Pharmacy, and ſignifies the Diſſolution of the Parts of a dry Body, in a moiſt or liquid one; for when the Body is ſo diſſolved, they ſay, *'tis diluted.*

DIMENSION [in *Geometry*] is either Length, Breadth, or Thickneſs: Thus a Line has, they ſay, one Dimenſion, *viz.* Length; a Surface two, *viz.* Length and Breadth; and a Body or Solid hath all three Dimenſions. 'Tis uſed alſo with Regard to the Powers of any Root in an Equation, which are called the *Dimenſions of that Root*; as in a Biquadratick Equation, the higheſt Power hath four Dimenſions, or its Index is Four.

DIMETIENT, the ſame with *Diameter.*

DIMINISHED *Angle*, a Term in Fortification. See *Angle.*

DIMINUTIO. See *Litotes.*

DIMINUTION [in *Muſick*] is nothing elſe but the diminiſhing or abating ſomewhat of the full Value or Quantity of any Note.

DIMINUTION [in *Rhetorick*] is the Orator's augmenting and exaggerating what he has to ſay, by an Expreſſion that ſeems to weaken and diminiſh it.

DIMINUTION [in *Architecture*] a Contraction of the Upper-part of a Column, whereby its Diameter is made leſs than that of the Lower-part.

DIMISSORY *Letters.* When a Candidate for Holy Orders hath a Title in one Dioceſe, and is to be ordain'd in another, the proper Dioceſan gives his Letters Dimiſſory directed to ſome other Biſhop, giving Leave that the Bearer may be ordain'd to ſuch a Cure within his Diſtrict.

DINUS [of *δῖνος*, *Gr.*] according to ſome, is the Diſeaſe called uſually the *Vertigo.*

DIOPTER [of *διοπτὴρ*, *Gr.*] is the ſame with the *Index* or *Albidada* of an *Aſtrolabe*, or the like Inſtrument.

DIOPTRA [of *διόπτομαι*, *Gr.* to ſee plainly] is an Inſtrument uſed by Chirurgeons, whereby one may ſee into the Matrix, otherwiſe called *Dilatorium*, wherewith the Womb is dilated and enlarged in the Extraction of a dead Fœtus out of it, or in the inſpecting any Ulcers that are in it. 'tis alſo called, the *Speculum Matricis.*

DIOPTRICKS, is a Part of Opticks, treating of the different Refractions of the Light paſſing thro' different Mediums, as the Air, Water, Glaſſes, *&c.*

DIORTHOSIS [*διορθωσις* of *διορθόω*, *Gr.* to make ſtrait] a Chirurgical Operation, by which crooked or diſtorted Members are made even, and reſtored to their primitive and regular Shape.

DIOTA, the Chymiſt's Term for a circulating or double Veſſel.

DIPHRYGES [in *Pharmacy*] the Scoriæ, Sediment, or Calx, of melted Copper, gathered in the Furnace when the Metal is run out.

DIPHTHONG [in *Grammar*] a double Vowel, or the Union and Mixture of the Vowels pronounced together, ſo as only to make one Syllable.

DIPLASIASMUS (of *διπλασιασμος*, *Gr.*] is a Reduplication of Diſeaſes; alſo two Muſclesof the Arm, which ſerve to turn it about. *Blanch.*

DIPLOE, is the lower thin Plate or Shell of the Skull; alſo a double Veſſel, uſually, with Chymiſts.

DIPLOMA [*διπλωμα* of *διπλόω*, *Gr.* to double, or fold up] the ſame with *Diploe*; ſometimes it is taken for a complicated or folded Cloth.

DIPPING *Needle*, is an *Engliſh* Diſcovery (Dr. *Wallis* thinks by Mr. *Blagrave*, or ſome other Greſhamite, *Philoſoph. Tranſ.* 276.) of a Property in the Magnetick Needle; but beſides its Polarity or Verticity, which is its Direction towards the North, in a Horizontal Poſition; it hath alſo a Direction of Altitude above the Horizon; and that it will (if duly poized about an Horizontal Axis) always point to a determinate Degree of Altitude or Elevation above the Horizon, in this or that Place reſpectively.

DIPSACUS [of *διψακός*, *Gr.*] according to ſome, is the ſame with *Diabetes.*

DIPTERON [of *διπτερος*, *Gr.*] in *Architecture*, is a Name which the Ancients attributed to thoſe Temples which were encompaſſed with a double Row of Pillars, making two Portico's, which they called *Wings*; but we commonly call them *Iſles*, from the *French* Word *Ailes*, of the ſame Signification.

DIPTOTES, are ſuch Nouns [in *Grammar*] as have but two Caſes, as *Suppetiæ*, *Suppetias*, *&c.*

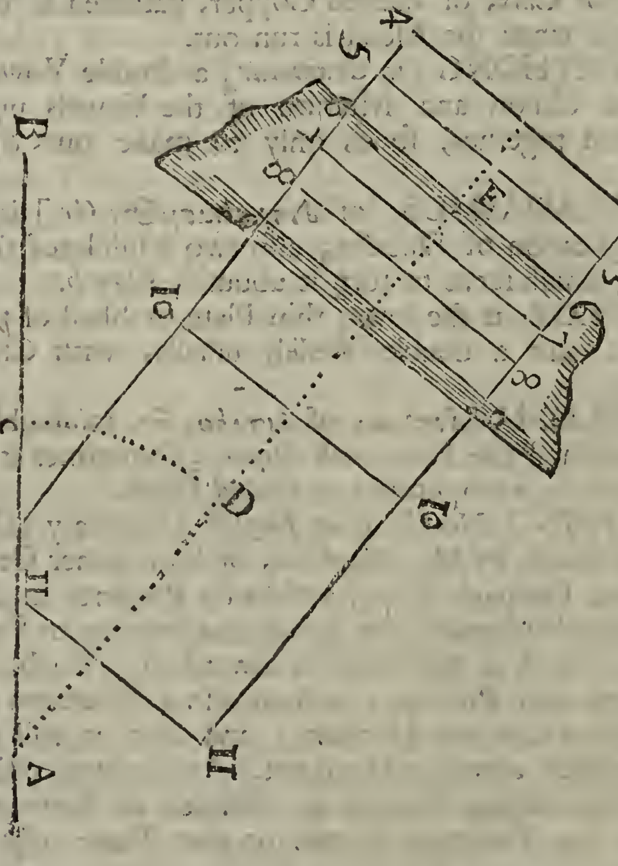
DIRECT [in *Aſtronomy*]. A Planet is ſaid to be direct, when, by its proper Motion, it goes forward in the Zodiack, according to the Succeſſion of the Signs, or rather when it appears ſo to do, the Obſerver's Eye being placed on our Earth.

DIRECT, *Erect, Eaſt* or *Weſt Dials*, are thoſe whoſe Plains lie directly open to the Eaſt or Weſt Points of the Heavens, or parallel to the Meridian of the Place.

To draw this Dial, the Style's Height may be found according to the Bigneſs of the Plane, and the Diſtance of the Hour-lines from each other, by the Direction given under *Polar Dials*, making of them a Table, as in the following one, for the *Lat.* 51 *Deg.* 32 *Min.*

Hours.	Angles at Pole.		Tangent.		Hours.
Eaſt.	D.	M.	Inch.	P.	Weſt.
4	30	00	5	77	8
5	15	00	2	68	7
6	Subſtyle.		00	00	6
7	15	00	2	68	5
8	30	00	5	77	4
9	45	00	10	00	3
10	60	00	17	32	2
11	75	00	37	32	1
12	Infinite.		Infinite.		

A Direct, Erect, Eaſt Dial, Lat. 51 *Deg.* 32 *Min.*



Then to deſcribe the Dial, draw the Horizontal Line AB; and with 60 Deg. from your Chords, deſcribe the prick'd Arch CD, whereon ſet the Co-Latitude of the Place from C to D. From A, thro' D, draw ADE, repreſenting the Equator of the Dial; then chuſe a Point in this Line to be the Hour of 6, as at E. Draw 6 *e* 6 at Right-angles with the Equator; and from E ſet off the ſeveral Tangents as you find them in the Table, and thoſe ſhall be the ſeveral Points for the Hours, and thro' each Point draw the Hour-lines parallel to the Equator, 6 *e* 6.

The Style may be a ſtraight Pin, equal in Height to the Right-line, 6, 9. in either Dial; or, which is better and more uſual, a Rod or Ledge of Iron, ſupported by two Legs, and ſet upon the Line, 6, 6. and of the ſame Height, 6, 9. as the Pin.

The Weſt Dial is made after the ſame manner, only ſet and numbred a contrary way.

DIRECT, *Erect, South* or *North Dials.* See *Prime Verticals.*

DIRECT, *Erect Planes.* See *Dial Planes.*

DIRECT $\left\{\begin{matrix}\textit{Inclining}\\ \textit{Reclining}\end{matrix}\right\}$ *Plains.* See *Dial Planes.*

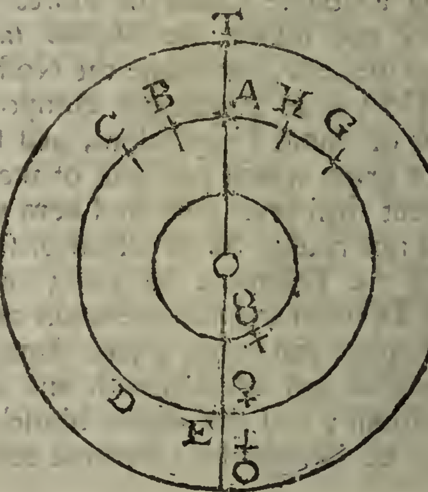
DIRECT *South or North* $\left\{\begin{matrix}\textit{Inclining}\\ \textit{Reclining}\end{matrix}\right\}$ *Dials*, are thoſe whoſe Planes $\left\{\begin{matrix}\textit{Incline}\text{ to the}\\ \textit{Recline}\text{ from the}\end{matrix}\right\}$ $\left\{\begin{matrix}\textit{Horizon,}\\ \textit{Zenith,}\end{matrix}\right.$ and lie directly open to the South or North.

Theſe Dials are deſcribed after the ſame manner with *Direct South Dials*, only obſerving this Rule in placing the Style:

In *South Incliners*, the Difference of the Angle of Inclination and the Height of the Pole, is the Height of the Style above the Plane.

If the Pole's Height be $\left\{\begin{matrix}\text{greater}\\ \text{leſſer}\end{matrix}\right\}$ than the Angle of Inclination, then the $\left\{\begin{matrix}\textit{North}\\ \textit{South}\end{matrix}\right\}$ Pole is elevated, and the Centre is $\left\{\begin{matrix}\text{below.}\\ \text{above.}\end{matrix}\right.$

DIRECT *Motion of a Planet.* To any Eye placed at the Earth's Surface, *Venus* and *Mercury*, which move round the Sun in leſſer Orbits than it doth, will ſometimes appear *Direct*, and ſometimes *Stationary* and *Retrograde.*

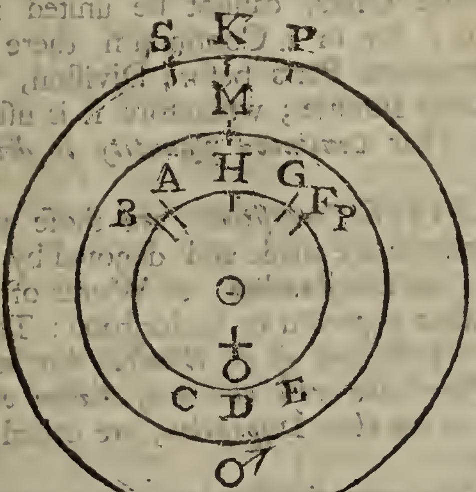


For let the Earth be at T, moving round the Sun in the Orbit T ♁, from Weſt to Eaſt. Let ACDF be the Orbit of ♀ revolving the ſame Way, but performing its Revolution in a ſhorter Time. It will then be plain, that when *Venus* is in that Part of her Orbit expreſſed in the Figure, by DEF, and which is moſt remote from the Earth, ſuppoſed to be in T; I ſay, *Venus* will then appear to move forward directly, according to the Order of Signs; or, *in conſequentia*, as the Aſtronomers ſpeak, and ſo is ſaid to be Direct. And when ſhe comes to ſuch a Poſition, in reſpect of the Sun and Earth, as to be in G: then, while ſhe moves from G to H, ſhe will ſeem to move with equal Celerity with the Sun, for then ſhe tends directly towards the Earth: Nor can ſhe appear to have any other Motion, than as if her Orbit was carried by the Sun moving towards the Eaſt: Therefore now ſhe will appear to move ſlower than before, but ſtill ſhe will be direct. But then ſhe gets beyond H, towards A, and then to B, ſhe in reality moving ſwifter than the Earth (becauſe nearer to the Sun) ſhe will paſs by between the Earth and the Sun; and therefore, to an Eye placed at the Earth, muſt appear to change her Place among the fix'd Stars, but yet contrary to the uſual Order of the Signs; that is, ſhe will appear to move in *Antecedentia*, and ſo is ſaid to be Retrograde; tho', if viewed from the Sun, ſhe would always appear to move Direct. And in the Part of the Orbit about H, he will appear Stationary, as they call it; becauſe then Right-lines drawn from the Sun to the Earth and Her, will appear to be parallel to one another for a conſiderable Time. Alſo, after her Retrogradation, and before ſhe begins to Direct again, ſhe will be again Stationary, as about B; and then ſhe is ſaid to be *Stationary towards her Direction*, as before ſhe was ſo *towards her Retrogradation*.

And 'tis the ſame Caſe, with reſpect to the Earth, conſider'd as moving on her Orbit; for the Directions, Stations, and Retrogradations, above deſcribed, and referred to *Venus*, will, after the ſame manner, appear to belong to the Earth, in the ſeveral Parts of her Orbit, to an Eye placed in *Venus*, or on the Surface of ſome ſuperior Planet.

And from what has been here ſaid, it appears, that *Venus* will appear Retrograde when ſhe is neareſt to the Earth, and conſequently then alſo appears bigger; and, on the other hand, will be Direct, and appear leaſt, when ſhe is remoteſt from the Earth.

After much the ſame manner will the Phœnomena of the Directions of the Stations and Retrogradations of the ſuperior Planets be accounted for by the following Figure:



Let M ♁ be the Orbit of one of the Superiors, ſuppoſe of *Mars*; let A C ♀ G be the Orbit of the Earth, and nearer to the Sun than that of *Mars*; let that Planet be ſuppoſed at M, and the Earth in that Part of her Orbit deſign'd by the Letter A; then will *Mars* appear Stationary, and that towards his Direction; becauſe the Right-lines drawn from *Mars*, and from the Earth to the Sun, will, for a while, appear to be parallel, altho', if *Mars* were ſeen from the Sun, his Motion would then appear to be progreſſive, as at other times: And while the Earth moves from A, towards B C D E, and F, to G, *Mars* will appear to move forward directly, among the fix'd Stars, for a double Reaſon; both becauſe it is in reality carried about the Sun *in conſequentia*, and alſo, becauſe the Earth is carried the ſame Way in the oppoſite Semicircle, and about the ſame Centre. *Mars* therefore being now moſt remote from the Earth, will appear to be direct. But the Earth coming at length to G, and *Mars* being ſuppoſed to be in M (which, in Proceſs of Time, will come to paſs) then he will appear Stationary again, and now towards his Retrogradation; for he will appear Retrograde in his Motion from G to A.

And the very ſame Phænomena muſt happen to *Jupiter* and *Saturn*, only the Retrogradations of *Saturn* will be more frequent than thoſe of *Jupiter*, and his than thoſe of *Mars*; becauſe the Earth will oftner follow, overtake, and get between *Saturn* and the *Sun*, than he will between *Jupiter* and him; and oftner alſo between *Jupiter* and the *Sun*, than between *Mars* and him.

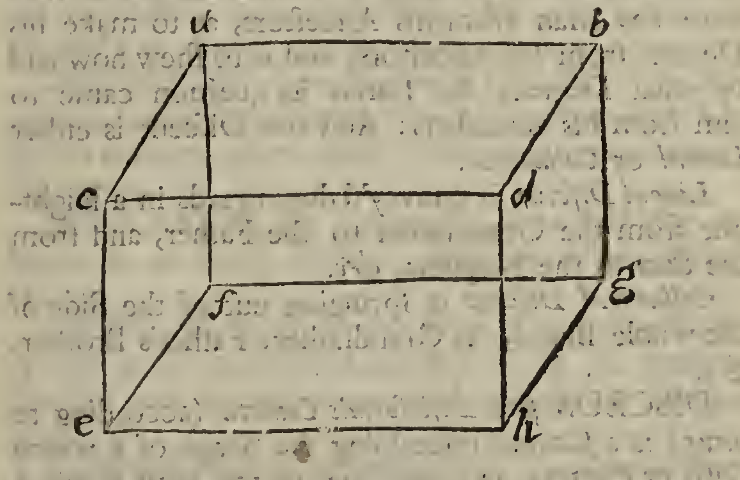
DIRECT *Ray*, [in *Opticks*] is the Ray which is carried from a Point of the viſible Object, directly to the Eye, thro' one and the ſame Medium.

DIRECT *Sphere*. See *Right Sphere*.

DIRECTION, a Term in *Mechanicks*, wherein, by the Line of Direction, they always mean the Line of Motion that any Body obſerves, according to the Force impreſſed upon it, and which is determined, or directed, to move ſuch a Way.

DIRECTRIX *of the Conchoid*. See *Conchoid*.

DIRIGENT, a Term in *Geometry*, expreſſing the Line of Motion, along which the Deſcribent-Line, or Surface, is carried in the Geneſis of any Plane or Solid Figure.



Thus, If the Line *a b* move along the Line *a c*, ſo that the Point *a* do always keep in the Line *a c*, a Parallelogram, as *a b c d*, will be form'd, of which the Side *a b* is the Deſcribent, and the Line *a c* the Dirigent: So alſo, if the Surface *a b c d* be ſuppoſed to be carried along the Line *c e*, in a Poſition always parallel to itſelf in its firſt Situation, the Solid *a d f h* will be formed where the Surface *a d* is the Deſcribent, and the Line *c e* is the Dirigent.

DISABILITY [in *Law*] is taken notice of four ſeveral ways; *viz.* by the Act of the Anceſtor; by the Act of the Party; by the Act of Law; and by the Act of God.

1. *Diſability by the Act of the Anceſtor*, is, if a Man be attainted of Treaſon or Felony; by this Attainder his Blood is corrupted, and thereby himſelf and his Children are diſabled to inherit.

2. *Diſability by the Act of the Party himſelf*, as if one Man make a Feoffment to another that then is Sole, upon Condition that he ſhall enfeoff a Third before *M.* and when ſuch Feoffment is made, the Feoffee takes a Wife, he hath, by that, diſabled himſelf to perform the Condition according to the Truſt in him repoſed; and therefore the Feoffer may enter, and out him. And if a Man be excommunicated, he cannot, during that Time, ſue any Action, but ſhall be thereby diſabled; and ſo in other Caſes.

3. *Diſability in Act of Law*, is properly when a Man, by the ſole Act of Law, is diſabled, and ſo is an Alien born; and therefore, if a Man born out of the King's Ligeance will ſue an Action, the Te-

nant or Defendant may ſay, that he was born in ſuch a Country out of the King's Ligeance, and demand Judgment, if he ſhall be anſwered; for the Law is our Birth-right, to which an Alien is a Stranger, and therefore diſabled to take any Benefit thereby.

4. *Diſability by the Act of God*, as to be *Non compos mentis*, or *Non ſanæ memoriæ*, which ſo diſables him, that in all Caſes where he gives or paſſes any Thing, or Eſtate, out of him, after his Death it may be diſannulled and avoided.

DISC, DISK [in *Aſtronomy*] the Body or Face of the Sun and Moon, ſuch as it appears to us. In a total Eclipſe of theſe Luminaries, the whole Disk is obſcured or darkened; in a partial Eclipſe, only Part of them.

The Disk is conceived to be divided into 12 equal Parts, called *Digits*; by means whereof it is, that the Magnitude of an Eclipſe is meaſured or eſtimated, as they ſay, ſuch an Eclipſe was ſo many Digits, or Parts, of the Sun or Moon's Disk.

DISC, DISK [in *Opticks*] is the Magnitude of Teleſcope-Glaſſes, or the Width of their Apertures, whatever their Form be, either Plain, Convex, Meniſcus, *&c.*

DISCENT [in *Common Law*] ſignifies an Order or Means, whereby Lands or Tenements are derived unto any Man from his Anceſtors, as to make his Diſcent from his Anceſtors, and is to ſhew how and by what Degrees the Lands in queſtion came to him from his Anceſtors: And this Diſcent is either *Lineal* or *Collateral.*

Lineal Diſcent is convey'd downwards in a Right-line from the Grandfather to the Father, and from the Son to the Nephew, *&c.*

Collateral Diſcent is ſpringing out of the Side of the whole Blood, as Grandfather, Father's Brother, *&c.*

DISCEUS *ſive Diſciformis Cometa* (according to ſome) is a Comet reſembling the Shape of a round Diſh or Platter; and the Chief of this kind is called a *Solar Comet*, from the Likeneſs of its Rays to thoſe of the Sun; and otherwiſe *Roſa* and *Chryſeus*, from its bright Silver Colour, mix'd with a Golden or Amber Colour. Thoſe of this ſort, which are not abſolutely circular, but reſemble the Figure of a Shield, and thence termed *Clypeiformes.*

DISCLAIMER [in *Law*] is a Plea containing an expreſs Denial or Refuſal; as if the Tenant ſue a Replevin upon a Diſtreſs taken by the Lord, and the Lord avow the taking of the Diſtreſs, ſaying, That he holdeth of him as of his Lord, and that he diſtrained for Rent not paid, or Service not performed; then the Tenant denying himſelf to hold of ſuch Lord, is ſaid to diſclaim, and the Lord proving the Tenant to hold of him, he loſes his Land.

DISCONTINUAL *Proportion.* See *Diſcrete Proportion.*

DISCONTINUANCE [in the *Common Law*] ſignifies the ſame as an Interruption or breaking off, and is of two kinds; either

DISCONTINUANCE *of Poſſeſſion*, the Effect of which is, That Man may not enter on his own Lands or Tenements alienated, whatſoever his Right be to them, of his own ſelf, or by his own Authority; but muſt bring his Writ, and ſeek to recover Poſſeſſion by Law. Or it is

DISCONTINUANCE *of Plea or Proceſs*; the Effect of which is, That the Inſtant is loſt, and may not be regain'd, but by a new Writ to begin the Suit afreſh; for, to be diſcontinued, and to be put *ſine die*, ſignifies, to be diſmiſs'd the Court finally.

DISCORDS [in *Muſick*] are certain Intervals of Sounds, which being heard, at the ſame time offend the Ear; nevertheleſs, when orderly taken and intermix'd with Concords, they make the beſt Muſick. Theſe Diſcords are, the Second, Fourth, and Seventh, with their Octaves; that is to ſay, all Intervals except thoſe few which preciſely terminate the Concords, are Diſcords.

DISCOURSE [in a *Logical* Senſe] is that rational Action of our Mind, by which we form or infer any new Judgment from others before made; or whereby we can infer or conclude one thing from another.

DISCOUNT [in *Commerce*] a Sum deducted or retained in hand, upon paying a greater, for Sums advanc'd before the Money comes due; alſo, an Allowance upon a Bill of Exchange, or other Debt not yet become due.

DISCRETE, or *Disjunct Proportion*, is, when the Ratio between two Pairs of Numbers or Quantity, is the ſame; but there is not the ſame Proportion between all the four Numbers: Thus, if theſe Numbers, 6 : 8 :: 3 : 4, are conſidered the Ratio between the firſt Part, 6 and 8, is the ſame as that between 3 and 4; and therefore theſe Numbers are proportional; but 'tis only diſcretely, or disjunctly; for 6 is not to 8, as 8 to 3; that is, the Proportion is broken off between 8 and 3, and is not continued all along, as it is in theſe following, which are called *Continual Proportionals*, *viz.* 3 : 6 :: 12 : 24.

DISCRETE *Quantity*, is ſuch as is not continued and joined together, as Number, whoſe Parts being diſtinct Units, cannot be united into one Continuum; for in a Continuum there are no actual determinate Parts before Diviſion, but they are potentially Infinite; wherefore it is uſually and truly ſaid, *That Continued Quantity is diviſible* in infinitum.

DISCRETIVE *Propoſitions*, are thoſe where various Judgments are made and denoted by the Particles (*but, notwithſtanding*) or Words of the like Nature, either expreſs'd or underſtood: Thus, *Fortune may deprive me of my Wealth, but not of my Virtue. They who croſs the Sea, change only their Country, but not their Diſpoſition,* are called *Diſcrete Propoſitions.*

DISCUS, among the *Romans*, was a round Quoit of Metal or Stone, about a Foot in Diameter, which, in ancient Exerciſes, they threw in the Air to ſhew their Strength: Alſo, they gave the ſame Name to a round Shield conſecrated to the Memory of ſome famous Hero, and hung up in the Temples of their Gods, as a Trophy for ſome great Action. From the Figure of either of which, but rather from the former, comes the Word ſo much in uſe among Aſtronomers, *viz.* the *Disk* of the Sun or Moon.

DISCUS [in *Botany*] is uſed to denote the middle, plain, and flat Part, of ſome Flowers, ſuch as *Caltha*, *Flos Solis*, *&c.* becauſe 'tis, in Figure, like the ancient *Diſcus*: And they reckon two kinds of Plants with a *Diſcous Flower.*

1. Such as have the Flower compounded, and the Seed pappous; but the Leaves and Stalks are not Milky when broken.

2. The Corymbiferous Plants, whoſe Flowers are compounded into a diſcous Figure, but their Seeds are not pappous. Of the former kind are the Fleabanes, Ragweeds, Groundſels, *&c.* and of the latter, are, Daiſies, Chamemile, Tanſy, Wormwood, *&c.*

DISCUSSION hath two Senſes among Writers;

ſometimes it ſignifies, the clear treating or handling of any particular Point or Problem, ſo as thereby the Word implies, to ſhake off thoſe Difficulties with which it is embarraſſed; and thus we ſay, *Such a Point was well diſcuſſed,* when it was well treated of, and cleared up. But

DISCUSSION is alſo uſed, in a Medicinal Senſe, for the diſperſing the Matter of any Tumour or Swelling in the Body, and therefore the Surgeons define Diſcuſſion to be an Evacuation of ſome thin Matter gathered in any Part, by inſenſible Evaporation; and this is procured by the Natural Heat being increaſed by proper Medicines.

DISCUSSIVES, DISCUTIENTS [in *Phyſick*] are Remedies proper to open the Pores, and evacuate the redundant Humours of the Body, by inſenſible Perſpiration; or to diſcharge Flatulencies, Swellings, *&c.* by ſhaking, *&c.* the ſame as *Diaphoreticks* and *Reſolvents.*

DISDIAPASON, a Term in *Muſick,* denoting a double Eighth or Fifteenth.

DISDIAPASON *Diapente,* [in *Muſick*] a Concord in a Sextriple Ratio of 1 to 6.

DISDIAPASON *Diateſſaron* [in *Muſick*] a Compound Concord in the Proportion of 16 to 3.

DISDIAPASON *Ditone* [in *Muſick*] a Compound Conſonance in the Proportion of 10 to 2.

DISDIAPASON *Semi-ditone* [in *Muſick*] a Compound in Proportion of 24 to 5.

DISEMBOGUE. When a Ship paſſeth out of the Mouth of ſome Gulph, they call it, *Diſemboguing:* They alſo ſay of a River, That at ſuch a Place, or after it hath run ſo many Leagues, it *diſembogues* itſelf into the Sea.

DISGRADING. See *Degrading.*

DISJUNCT *Proportion,* the ſame with *Diſcrete:* Which ſee.

DISJUNCTIVE *Propoſitions,* are thoſe wherein the Disjunctive, Conjunction (*or*) is found; as, *Either the Sun moves about the Earth, or the Earth about the Sun; Men are guided either by Intereſt or Fear.*

DISLOCATION, the ſame with *Luxation,* or putting a Limb or any Bone of the Body out of Joint.

DISMES *Decimæ,* are Tythes, and ſignify the Tenth-part of all the Fruits of the Earth, or tame and profitable Beaſts of it, or of Mens Labour.

DISMOUNT [in the *Common Military Uſe*] is, to unhorſe, or to diſmount the Cavalry; but they call it alſo *Diſmounting of Cannon,* when they are thrown off the Carriages, and are broken; or any Horſe rendred unfit for Service.

DISORIENTATED [in *Aſtronomy*] turned from the Eaſt, or ſome other of the Cardinal Points: It is alſo uſed, in a figurative Senſe, for the diſconcerting, or putting a Man out of his Way or Element, as if you diſcourſe of Law to a Phyſician, and Phyſick to a Lawyer, they will be *diſorientated,* and ſometimes *diſoccidentated* is uſed for *diſorientated.*

DISPARAGEMENT [in the *Law* Senſe] is uſed eſpecially for matching an Heir in Marriage under his or her Degree, or againſt *Decency.*

DISPART, a Term in Gunnery, ſignifying the ſetting a Mark on the Muzzle-Ring of a Piece of Ordnance, or thereabouts, ſo that a Right-line taken upon the Top of the Baſe-Ring againſt the Touch-hole, by the Mark ſet on or near the Muzzle, may be parallel to the Axis of the Concave Cylinder. The common way of doing which, is, to take the two Diameters of the Baſe-Ring, and of the Place where the Diſpart is to ſtand, and divide the Difference between them into two equal Parts, one of which will be the Length of the Diſpart, which is ſet on the Gun with Wax or Pitch, or faſtened there with a Piece of Twine or Marlin: But an Inſtrument may be made, to do it to all poſſible Nicety.

DISPAUPERED. When any Perſon, by Reaſon of his Poverty, atteſted by his own Oath of not being worth 5 *l.* (his Debts being paid) is admitted to ſue in *Forma Pauperis;* if afterwards, before the Suit be ended, the ſame Party have any Lands or Perſonal Eſtate fallen to him; or that the Court where the Suit depends think fit, for that or any other Reaſon, to take away that Privilege from him, he is then ſaid to be *Diſpaupered; i. e.* put out of the Capacity of ſuing any longer in *Forma Pauperis.*

DISPENSATION *of a Law,* is a Thing diſtinct from the Equity of it, or from an equitable Conſtruction of it: For Equity is only the Correction of a Law that is too Univerſal or General; but a Diſpenſation ſuſpends the Obligation of the Law itſelf. A Diſpenſation therefore muſt be from the Legiſlative Power, and ſhould be but very rarely and ſparingly uſed. *L.*

DISPENSATORY, is a Book uſed by Apothecaries, wherein all Medicines, at leaſt the moſt uſual, are contained and preſcribed, that they may be prepared in the Shops all the Year round.

DISPERSION [in *Dioptricks*] as *Point of Diſperſion,* is the Point from which refracted Rays begin to diverge, when their Refraction renders them divergent.

DISPLAYED, the Term [in *Heraldry*] for an Eagle in an erect Poſture, and her Wings ſpread abroad.

DISPONDÆUS is the Foot of a *Latin* Verſe, conſiſting of four Syllables, and thoſe all long, as *Concludentes,* ſo that this is a Compoſition of two *Sponde's.*

DISPOSITION. See *Method.* In *Architecture,* they call the juſt placing of all the ſeveral Parts of an Edifice, according to their proper Order, *Diſpoſition.*

DISQUISITION, an Enquiry into the Nature, Kinds, and Circumſtances, of any Problem, Queſtion, or Topick, in order to gain a right Notion, and to diſcourſe clearly of it.

DISSEISIN [in *Law*] ſignifies an unlawful diſpoſſeſſing a Man of his Land, Tenement, or other immovable or incorporeal Right.

DISSEISIN *upon Diſſeiſin,* is, where the *Diſſeiſor* is diſſeiſed by another.

DISSIMILAR *Leaves,* are the two firſt Leaves of any Plant at its firſt ſhooting out of the Ground; and are ſo called, becauſe they uſually are of different Form from the common Leaves of the grown Plant. Theſe Dr. *Grew* obſerves to be nothing but the very Lobes of the Seed expanded, and thus advanced: Their Uſe is, for the Protection of the Plume, which being young and tender, is thus guarded on each Side, and alſo hath ſome Rain or Dew gradually conveyed down to it by this Means.

DISSIMILAR *Parts* [in *Anatomy*] (by ſome called *Compound* and *Organical*) are ſuch as can be divided into various Parts different from one another; as the Hand is into Veins, Muſcles, Bones, *&c.* whoſe Portions are neither of the ſame Nature nor Denomination.

DISSOLVING *Medicines.* See *Diſcuſſion.*

DISSOLUTION is, when Electuaries and Powders are mingled and diſſolved in Water, or a Decoction. *Blanch.*

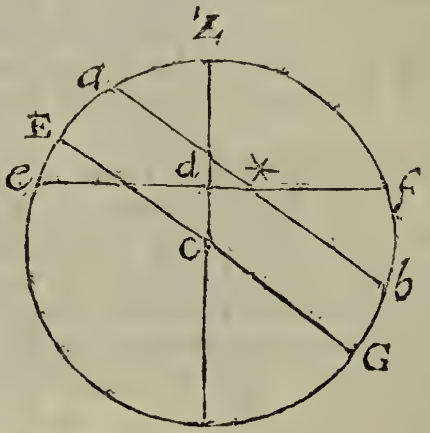
DISSONANCE [in *Muſick*] is a diſagreeable

Interval between two Sounds, which, being continued together, offend the Ear.

DISTANCE [in *Navigation*] is the Number of Degrees, or Leagues, *&c.* that a Ship has ſailed from any given Point.

DISTANCE *of Places*, on the Earth, are eaſily found by the Analemma. Thus:

Having the Longitudes and Latitudes of any two Places on the Earth; to find their Diſtance.



Let *London* be one Place at Z, and let the other be in 20 Deg. North Latitude, and whoſe Difference of Longitude from *London* is 82 Deg. 30 Min. Eaſt. Take from the Chords Z E = 51 Deg. 30 Min. and draw E C Q for the Æquator; and to it, at 20 Deg. Diſtance, draw *a b* for the Parallel of the other Place: Then from *b*, where the Meridian of *London* interſects that Parallel, ſet *b* ✱ = 82 Deg. 30 Min. the Difference of Longitude, and that will find the Point ✱ in the Parallel, repreſenting the Place. Thro' ✱ at Right-angles to *Z c*, draw *e d*, croſſing the Vertical Circle in *d*; meaſure *c d* on the Sines, it will be about 20 Deg. whoſe Complement, 70 Deg. is the Places Diſtance from *London*, or Z Multiply 70 by 70, you have 4900 Miles, the Diſtance required.

DISTANCE *of the Baſtions* [in *Fortification*] is the Side of the Exterior Polygon.

DISTANCE *of the Eye* [in *Perſpective*] is a Line drawn from the Foot of the Line of Altitude of the Eye, to the Point where a Line drawn at Right-angles to it, will interſect the Object.

DISTANCE *of the Sun from the Moon's Node*, [in *Aſtronomy*] is an Arch of the Ecliptick intercepted between the Sun's true Place and the Moon's Node or Apogee.

Curtate DISTANCE [in *Aſtronomy*] the Diſtance of the Planet's Place from the Sun reduc'd to the Ecliptick.

Line of DISTANCE [in *Proſpective*] is a Right-line drawn from the Eye to the principal Point.

Point of DISTANCE [in *Perſpective*] is a Point in the Horizontal-Line at ſuch Diſtance from the principal Point, as that of the Eye is from the ſame.

DISTEMPER, a Term [in *Painting*] for the working up of Colours with ſomething elſe beſides bare Water or Oil; for if the Colours are prepared with the former of theſe, that kind of Painting is called *Limning*; and if with Oil, 'tis called *Painting in Oil*, and *ſimply Painting*; but if the Colours are mix'd with Size, Whites of Eggs, or any ſuch proper glutinous or unctuous Subſtance, and not with Oil, they then ſay, *'Tis done in Diſtemper*, as the admirable *Cartons* are at *Hampton Court*.

DISTENTION is, when Parts are puffed up, dilated or relaxed by any thing; as the Guts, by Wind, raiſed from Effervеſcencies within them, whence Oppreſſions and Pains frequently proceed. *Blanch.*

DISTILLATION is drawing off ſome of the Principles of a Mixture, as the Oil, Spirit, Water, *&c.* in proper Veſſels, by the Help of a Fire; and is two-fold.

1. *Per Aſcenſum*, when the Matter to be diſtilled is above the Fire.
2. *Per Deſcenſum*, when the Matter to be diſtilled is below the Fire, and ſo the Vapour not being able (by the Contrivance of the Veſſel) to riſe upward, is forced to precipitate, and to diſtil down to the Bottom of the Veſſel.

Oil of Cloves, if you would have it White, is beſt made this way.

DISTILLATION *of Vegetables or Minerals*, is very different, according to the Nature of the Body to be diſtilled. Acid Spirits are drawn in a ſtrong Retort, and with very great Fires, and uſually in a Reverberatory Furnace. Ponderous Woods are diſtilled in a Retort after the ſame manner, and with near the ſame Degree of Heat, ſuch as *Guajacum*, *Box*, *&c.* and in theſe firſt comes a little Phlegm, and then the Fire increaſing, the Spirits fly out in white Clouds; when they ceaſe to come, the Matter in the Receiver is filtrated through a Tunnel lin'd with Cap-Paper; the Spirit will paſs, but leave the black fœtid Oil in the Tunnel, which afterwards may be rectified (if it be worth while) by making it up into Pellets with Sand, and then diſtilling it over again in a naked Fire, there will come over a clear Oil. The Spirit alſo may be rectified by diſtilling it over again in a Glaſs Alembick: Put Fire to the black Coals remaining in the Retort, and they will ſoon kindle and turn to Aſhes; which Aſhes may be calcined a while in a Potter's Furnace, and then a Lixivium being made of them with Water, and the Water filtrated and evaporated, the fix'd Salt of the Wood will remain at the Bottom; and thus all the five Principles may be drawn from Amber, Ponderous Woods, *&c.*

Plants that are Odoriferous, are to be diſtilled *per Veſicam*, but firſt let a ſtrong Decoction of the ſame Plant be poured hot upon the Plant itſelf bruiſed and put into the Body, and there let the Matter digeſt two Days, the Veſſel being cloſe ſtopp'd. Then fit all things for Diſtillation, and with a Fire of the ſecond Degree, draw off about half the Water you poured on the Plant; this will be a very good Water, and taſte and ſmell ſtrongly of the Plant.

Preſs thro' a Cloth ſtrongly what remains in the Body, filtrate and evaporate in a gentle Heat till the Matter be of the Conſiſtence of thick Honey. This is the Extract of the Plant; but the Extracts of Odoriferous Plants are not ſo good as thoſe of Vegetables which are not ſo, becauſe Abundance of the finer Volatile Parts evaporate with the Moiſture.

Dry what remained in the Cloth after Expreſſion, and then burn it (with more of the Plant dried, if you will): Make a Lixivium of the Aſhes, and then filtrate and evaporate to Drineſs, and the fix'd Salt of the Plant will remain at the Bottom. And thus may Balm, Wormwood, Sage, Hyſſop, *&c.* be diſtill'd, and their Waters, Oils, and Extracts made, and their fix'd Salts gain'd.

To diſtil Plants that are not Odoriferous, 'tis beſt to proceed thus: Pound the Plant, and then fill two Thirds of the Veſica or Alembick with it, and after that, pour on a good Quantity of the expreſſed Juice of the ſame Plant, ſo that the bruiſed Matter may float in the Juice, and not ſtick to the Bottom or Sides of the Veſſel: Then fit on the Head, and draw off about Half as much Water as you uſed Juice; this will be a very good diſtill'd Water of that Plant. Preſs thro' a Cloth what remains in the Still, and let the Juice ſettle; then filtrate it, and after that, in a ſmall Heat, evaporate about Two-Thirds of the Liquor in a Glaſs or Earthen Veſſel; then remove the Veſſel into a Cellar, or ſome ſuch cool Place, and the Eſſential Salt will ſhoot out into Chryſtals; which gather, and keep in a Viol well ſtopp'd; or you may make the Extract fixed Salt of it as above directed, as of an Odoriferous Plant.

To diſtil a Spirit from any Plant like that of Scurvy-graſs, they proceed thus: The Plant is pounded to a Pulp in a Marble Mortar, and then put into an Earthen-Veſſel, ſo as to fill it but half full; after which, the expreſſed Juice of the ſame Plant is poured upon it till it be about 6 Inches above the Matter. After this, they mix with it all about a Pint of Yeſt or Barm; and then ſtopping the Veſſel, they ſet it to ferment, either in the warm Sun, or in Horſe-Dung, for three or four Days, or more, if it be cold Weather. As ſoon as you perceive that it hath done fermenting, and that its Surface begins to ſink or ſubſide, put the Matter ſpeedily into a Cucurbite or Veſica, and luting on the Head, ſet the Veſſel in a Balneum Vaporis, and diſtil, with a gentle Fire, about two Pints of the Liquor, which will be very ſpiritous; and if you rectify again, and draw off Half of it, it will be a very fine Spirit. What remains in the Body may be diſtill'd farther, and a Water will run off, that is as good or better than any diſtill'd Water of that Plant drawn in the common way.

After this manner alſo the ardent or inflammable Spirit of Roſes, *&c.* may be drawn.

DISTINCT *Baſe* [in *Opticks*] is that preciſe Diſtance from the Pole of a Convex Glaſs, in which Objects, beheld thro' it, appear diſtinct and well-defined; ſo that 'tis the ſame with what is otherwiſe called the *Focus*. The Diſtinct Baſe is cauſed by the Collection of the Rays proceeding from a ſingle Point in the Object, into a ſingle Point in the Repreſentation; and therefore Concave Glaſſes, which do not unite, but ſcatter and diſſipate the Rays, can have no real Diſtinct Baſe.

DISTINCT *Viſion*. See *Viſion*.

DISTORTION is a Contraction, or ſhortening of one Side of the Mouth, occaſioned by a Convulſion or Palſy of the Muſcles of one Side of the Face; alſo, is when the Parts of an Animal Body are ill-placed, or ill-figured.

DISTORTOR *Oris* [in *Anatomy*] a Muſcle of the Mouth, called alſo *Zygomaticus*. *L.*

DISTRACTION [in *Phyſick*] the Act of pulling a Fibre, Membrane, or the like, beyond its natural Extent.

DISTRESS [in *Law*] ſignifies a Compulſion in certain real Actions, whereby to bring a Man to appear in Court, or to pay a Debt of Duty denied; the Effect thereof, moſt commonly, is to drive the Party diſtrained to replevy the Diſtreſs, and ſo to take his Action of Treſpaſs againſt the Diſtrainer, or elſe to compound with him for the Debt or Duty for which the Diſtreſs was made. There are ſeveral Things not diſtrainable; for a Diſtreſs muſt be of a Thing whereof a valuable Property is in ſomebody, and therefore Dogs, Bucks, Coneys, and the like, that be *feræ naturæ*, cannot be diſtrained. 2. Altho' it be of a valuable Property, as a Horſe, (yet when a Man or Woman is riding on him) or an Ax (in a Man's Hand cutting Wood) and the like, are for that Time privileged, and cannot be diſtrained. 3. Valuable things ſhall not be diſtrained for Rent, for Benefit and Maintenance on Trades, which, by Conſequence, are for the Commonwealth, and are, by Authority of the Law, there; as, a Horſe in the Smith's Shop, Materials in the Weaver's Shop for making Cloth, Cloth or Garments in the Taylor's Shop, Sacks of Corn or Meal in a Mill, nor in a Market, nor any thing diſtrained for Damage-feaſant, for it is *in Cuſtodia Legis*. 4. Nothing ſhall be diſtrained for Rent, that cannot be rendred again in as good Plight as it was at the Time of the Diſtreſs taken; as Sheaves or Shocks of Corn cannot be diſtrained for Rent, but for Damage-feaſant they may. 5. Beaſts belonging to the Plough ſhall not be diſtrained, but Goods may. 6. Furnaces, Cauldrons, or the like, fix'd to the Freehold, or the Doors or Windows of a Houſe, or the like, cannot be diſtrained. When a Diſtreſs that hath Life in it, is taken, it muſt be brought into the common Pound, or kept in an open Place, where the Owner may give it Food.

Diſtreſs is taken to be either *Real* or *Perſonal*: *Diſtreſs Real* is made upon immoveable Goods, as the Grand-Cape and Petit-Cape, by which the Land itſelf is ſeized. *Diſtreſs Perſonal* is made by taking a Man's moveable Goods, and detaining them for Security of his Appearance to the Suit. Diſtreſs is alſo either *Finite* or *Infinite*: *Finite* is that which is limited by Law, how often it ſhall be made to bring the Party to Trial of the Action. *Diſtreſs Infinite* is with Limitation until the Party come, as againſt a Jury that refuſeth to appear *Super Certificatione Aſſiſæ*, where the Proceſs is a *Venire facias*, *habeas corpora*, and *Diſtreſs Infinite*, *&c.*

DISTRIBUTIO *Chyli*, the Chyle is diſtributed when, after a due Fermentation in the Ventricle and the Guts, it ſoaks into and thro' the Glandulous Tunick of the Inteſtines; and paſſing through the Lacteal Veins, and its proper Channel along the Side of the Thorax, at laſt falls into the Subclavian Vein, that it may circulate with the Blood, and receive its Colour. *Blanch.*

DISTRIBUTION [in *Architecture*] is the dividing and diſpenſing the ſeveral Parts and Pieces which compoſe the Plan.

DISTRICHIASIS, is a double Row of Hair on the Eye-lids.

DISTRINGAS, is a Writ directed to the Sheriff, or any other Officer, commanding him to diſtrain one for Debt to the King, *&c.* or for his Appearance at a Day.

DISVELOPED [in *Heraldry*] is uſed much in the ſame Senſe with diſplay'd, as flying Colours are ſaid to be Diſveloped.

DITHYRAMBICK [of διθυραμβος, *Gr.*] a Hymn in Honour of *Bacchus*, full of Tranſport and poetical Rage.

DITONE, a double Tone, or the greater Third, is an Interval in Muſick which comprehends two Tones; the Proportion of the Tones that make the Ditones, is as 4 to 5, and that of the Semiditones as 5 to 6.

DITRIGLYPH [in *Architecture*] the Space between two Triglyphs.

DIVERGENCE *Point*. See *Vertical Focus*.

DIVERGENT, or *Diverging Rays* [in *Opticks*] are thoſe Rays which, going from a Point of the viſible Object, are diſperſed, and continually depart one from another, according as they are removed from the Object.

DIVERGENT *Lines* [in *Geometry*] are ſuch whoſe Diſtance is continually increaſing.

DIVERGING *Hyperbola*, is one whoſe Legs turn their Convexities towards one another, and run towards quite contrary ways.

DIVIDEND [in *Arithmetick*] is the Number propoſed to be divided into certain equal Parts.

DIVIDUAL, is that Part of the Dividend diſtinguiſhed by a Point, in working by the Rule of Diviſion in Arithmetick.

DIVINATORIA *Virgula*: See *Virgula Divinatoria*.

DIVING-BELL, is a Machine contriv'd to remedy ſeveral Inconveniencies in Diving, in this the Diver is ſafely convey'd to any reaſonable Depth, and may ſtay more or leſs Time under Water, as the Bell is greater or leſs.

'Tis moſt conveniently made in the Form of a truncated Cone, the ſmaller Baſe being cloſ'd, and the larger open, it is to be pois'd with Lead, and ſo ſuſpended, that the Veſſel may ſink full of Air, with its open Baſis downward, and as near as may be in a Situation parallel to the Horizon, ſo as to cloſe with the Surface of the Water all at once.

Under this Couvercle the Diver ſitting, ſinks down with the included Air into the Depth deſired; and if the Cavity of the Veſſel may contain a Tun of Water, a ſingle Man may remain a full Hour, without much Inconvenience, at 5 or 6 Fathom deep: But the lower you go, ſtill the included Air contracts itſelf, according to the Weight of the Water that compreſſes it; ſo as at 33 Foot deep, the Bell becomes half full of Water; the Preſſure of the incumbent Water being then equal to that of the Atmoſphere, and at all other Depths the Space occupied by the compreſſed Air in the upper Part of the Bell will be to the under Part of its Capacity fill'd with Water as 33 Feet to the Depth of the Surface of Water in the Bell below the common Surface thereof, and this condenſed Air being taken in with the Breath, ſoon inſinuates itſelf into all the Cavities of the Body, and has no ill Effect, provided the Bell be permitted to deſcend ſo ſlowly as to allow Time for that Purpoſe.

One Inconvenience that attends it, is found in the Ears, within which there are Cavities, which open only outwards, and that by Pores ſo ſmall, as not to give Admiſſion even to the Air itſelf, unleſs they be dilated, and diſtended by a conſiderable Force. Hence, on the firſt Deſcent of the Bell, a Preſſure begins to be felt on each Ear, which, by Degrees grows painful, till the Force overcoming the Obſtacle, what conſtringes theſe Pores, yields to the Preſſure, and letting ſome condenſed Air ſlip in, preſently Eaſe enſues; the Bell deſcending lower, the Pain is renewed, and again eas'd in the ſame Manner.

But the greateſt Inconvenience of this Engine, is, that the Water entring it, contracts the Bulk of Air into ſo ſmall a Compaſs, that it ſoon heats, and becomes unfit for Reſpiration; ſo that there is a Neceſſity for its being drawn up to recruit it, beſides the uncomfortable abiding of the Diver almoſt cover'd with Water.

To obviate theſe Difficulties of the Diving-Bell, Dr. *Halley*, to whom we owe the preceeding Account, contriv'd ſome further *Apparatus*, whereby not only to recruit and refreſh the Air from time to time, but alſo to keep the Water wholly out of it at any Depth, which he effected after the following Manner.

His Diving-Bell was of Wood about 60 Cubic Feet in its Concavity, coated externally with Lead, ſo heavy that it would ſink empty; a particular Weight being diſtributed about its Bottom, to make it deſcend perpendicularly, and no otherwiſe; in the Top was fix'd a Glaſs like a Window, to let in Light from above, with a Cock to let out the hot Air; and below, about a Yard under the Bell, was a Stage ſuſpended from it by three Ropes, each charg'd with an hundred Weight, to keep it ſteady.

To ſupply Air to this Bell, when under Water, he had a Couple of Barrels, holding 36 Gallons a-piece, caſed with Lead, ſo as to ſink empty, each having a Bung-hole at Bottom, to let in the Water as they deſcended, and let it out again as they were drawn up again; in the Top of the Barrels was another Hole, to which was fix'd a leathern Pipe, or Hoſe, long enough to hang below the Bung-hole, being kept down by a Weight appended, ſo that the Air driven to the upper Part of the Barrel by the Encroachment of the Water in the Deſcent, could not eſcape up this Pipe, unleſs the lower End were lifted up.

Theſe Air Barrels were fitted with Tackle, to make them riſe and fall alternately, like two Buckets, being directed in their Deſcent by Lines faſten'd to the under Edge of the Bell, ſo that they came readily to the Hand of a Man plac'd on the Stage to receive them; and who taking up the Ends of the Pipes, as ſoon as they came above the Surface of the Water in the Barrel, all the Air included in the upper Part thereof was blown forcibly into the Bell, the Water taking its place.

One Barrel thus receiv'd and emptied, upon a Signal given it was drawn up, and at the ſame time the other let down; by which alternate Succeſſion freſh Air was furniſhed ſo plentifully, that the Learned Doctor himſelf was one of five, who were altogether in 9 or 10 Fathoms deep of Water for above an Hour and half, without the leaſt Inconvenience, the whole Cavity of the Bell being perfectly dry.

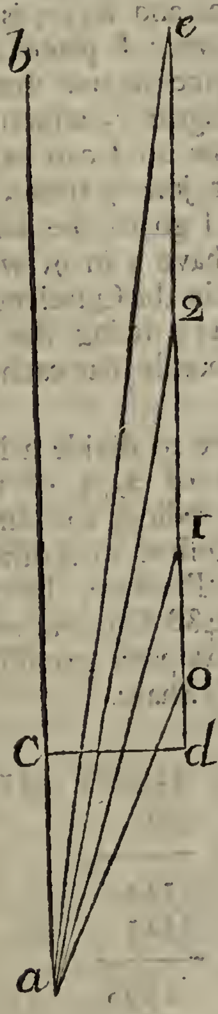
All the Precaution he obſerv'd, was to be let down gradually about 12 Foot at a time, and then to ſtop, and drive out the Water that had enter'd, by taking in 4 or 5 Barrels of freſh Air before he deſcended further, and being arrived at the Depth intended, he let out as much of the hot Air that had been breath'd, as each Barrel would repleniſh with Cold, by means of the Cock at the Top of the Bell; thro' whoſe Apperture, tho' very ſmall, the Air would ruſh with ſo much Violence, as to make the Surface of the Sea boil.

Thus, he found, any Thing could be done that was required to be done underneath, and by taking off the Stage, he could, for a Space as wide as the Circuit of the Bell, lay the Bottom of the Sea ſo far dry, as not to be over Shoes therein. Beſides, that by the Glaſs Window ſo much Light was tranſmitted, that, when the Sea was clear, and eſpecially when the Sun ſhone, he could ſee perfectly well to write or read, much more to faſten, or lay hold of any thing under him that was to be taken up; and by the Return of the Air-Barrels, he often ſent up Orders written with an Iron Pen on a Plate of Lead, directing how he would be mov'd from Place to Place.

At other times, when the Water was troubled and thick, it would be as dark as Night below; but in ſuch Caſes he was able to keep a Candle burning in the Bell. The ſame Author intimates, that by an additional Contrivance, he has found it practicable for a Diver to go out of the Bell to a good Diſtance from it; the Air being convey'd to him in a continued Stream by ſmall flexible Pipes, which ſerve him as a Clew to direct him again to the Bell, ſo that there ſeems little further wanting to the Perfection of Diving.

DIVISIBLITY, is that Diſpoſition of a Body, whereby it is conceived to have Parts, into which it may actually or mentally be divided.

All Quantity is infinitely, or rather indefinitely diviſible; for ſhould it be otherwiſe, it would be diviſible into Parts that are not *Quantæ*, which cannot be, for no accidental Change can deſtroy the eſſential Properties of a Being: Yet this infinite Diviſibility can never actually be effected, becauſe when you have divided a Line, or any other Quantity, into any Number of Parts, every one of theſe Parts is further diviſible into as many Parts as the whole was, and ſo on, as is many ways demonſtrable in Geometry; wherefore there can be no ſuch Thing as a determinate Number of actual Parts in any continued Quantity; which is farther alſo demonſtrable from the Conſideration of incommenſurable Quantities; as *that the Diagonal of a Square is incommenſurable with its Side*, as *Euclid* proves, *Lib.* 10. *Prop.* 117. And that the Parts in any Line are infinite or indefinite, will plainly appear by the following Diagram.



Let the Line *a b* be conceived to be drawn parallel to *d e* at the perpendicular Diſtance *c d*, which ſuppoſe to be half an Inch: 'Tis plain, the Line *d e* being capable of being infinitely produc'd, there may be taken in it as many Points, *o*, 1, 2, *e*, as you pleaſe; and from *a* to each of them can a Right Line be drawn, as in the Figure, which will divide the Line *c d*, though but of one $\frac{1}{2}$ an Inch in Length, into as many Parts as you take in the lower Parallel *d e*. And though the Diviſions in the Line *c d* do ſtill leſſen upwards, yet they can never become nothing, becauſe no Line drawn from *a* to any Part of *d e*, though never ſo remote, can poſſibly ever coincide with the upper Parallel *a b*.

See alſo the Learned Mr. *Keil's* 4th Philoſophical Lecture, read in the Univerſity of *Oxon*, and lately publiſh'd.

And that the Parts of ſolid Bodies are almoſt infinitely ſmall, and that they are capable of being divided wonderful minutely, the Honourable Mr. *Boyle* ſhews by theſe Inſtances,

1. A Piece of Silver Wire was drawn ſo ſmall, that the Weight of but a Grain would reach to 27 Foot, or 324 Inches in Length; and ſince an *Engliſh* Inch can eaſily be divided into 200 equal Parts, one Grain of this Wire may be divided into 64800 Parts; and ſince this Diviſion relates only to the Surface of the Wire, its Solidity may eaſily be conceived to conſiſt of many Millions of ſuch Parts.

2. One of the Oval Caſes of Silk-Worms was drawn out into a Length that much exceeded 300 Yards, and yet weighed but two Grains and an half; ſo that each Cylindrical Grain of that Silk, was at leaſt 120 Yards in Length.

3. A Grain of Leaf Gold was extended into an Area of above 50 Inches; and then ſuppoſing the Area reduced to a Square, and its Sides divided after the Manner above-mention'd, *i. e.* ſo that there be 200 Diviſions in an Inch; If parallel Lines be ſuppoſed to be drawn through thoſe ſubtile Diviſions, the Area will be divided into no leſs than two Millions of little Squares.

4. If you ſuppoſe the Silver Wire mentioned above, to be gilt with Gold (and allow for the Gilding 8 Grains of Gold to an Ounce of Silver, which yet is more than is commonly uſed) you will find an Ounce of Gold will cover as much Wire will reach to 155½ Miles in Length.

5. By diſſolving one Grain of Crude Copper in a good Proportion of Spirit of *Sal Armoniack*, a deep blue Colour was produced, and after this a good Quantity of diſtill'd Water was put to it to dilute it, yet ſo as that the blue Colour did ſtill remain viſible; and on the comparing the Weight of the Liquor with the Grain of Copper firſt diſſolved, it was found, that one Grain was capable of imparting a ſenſible Colour to above 513620 times its Bulk of Liquor.

DIVISION, in general, ſignifies the diſtributing or parting of any Whole into its proper Parts; and is only a Compendium of Subtraction; for the Diviſor is ſo many Times contain'd in the Dividend, as there are Units in the Quotient; ſo that ſubtracting continually the Diviſor from the Dividend, and accounting an Unit for each Time, the Sum of thoſe Units is the Quotient.

In Diviſion, the Number or Quantity to be divided, is called the Dividend; that by which you divide, the Diviſor; and the Number of Times that the Dividend contains the Diviſor, is called the Quotient or Quota, and ſometimes the Parabola; the Reaſon of which, ſee under that Word.

In all Diviſion, as one is to the Diviſor; ſo is the Quotient to the Dividend; wherefore though in whole Numbers the Quotient muſt always be leſs than the Dividend, yet in Fractions it muſt always be greater.

Thus, let 36 be divided by 4, the Quotient is 9, leſs than 36, becauſe, ſince 1 : 4 : : 9 : 36; 1 being leſs than 4, 9 muſt be alſo leſs than 36: But if $\frac{4}{5}$ were to be divided by $\frac{2}{4}$ the Quotient $\frac{16}{10}$ will be much bigger than the Dividend $\frac{4}{5}$, becauſe as 1 : : $\frac{2}{4}$: : 10 : $\frac{4}{5}$, (*i. e.*) as one is the Diviſor : : ſo is the

Quotient to the Dividend; but 1 is greater than $\frac{2}{4}$ or $\frac{1}{2}$, wherefore $\frac{16}{10}$ muſt alſo be greater than $\frac{2}{5}$.

DIVISION [in *Species* or *Algebra*] is, in general, the reducing the Dividend and Diviſor to the Form of a Fraction, which Fraction is the Quotient: Thus, if ab were to be divided by cd, it muſt be placed thus, $\frac{ab}{cd}$, and that Fraction is the Quotient; though ſome chuſe to write it thus, $cd)\,ab$, or $ab \div cd$. which laſt Mark $\div$ is the common Character for Diviſion.

For the performing the Work of Diviſion Algebraically, obſerve theſe Rules.

1ſt Rule, When the Dividend is equal to the Diviſor, the Quotient is Unity, and muſt be placed in the Quotient, becauſe every Thing contains itſelf once.

2d Rule, When the Quotient is expreſs'd Fraction-ways (as in Simple Diviſion) if the ſame Letters are found equally repeated in every Member of the Numerator and Denominator, caſt away thoſe Letters, and the Remainder is the Quotient: Thus, $\frac{ab}{b}(a$, and $\frac{abc}{ab}(c$. *&c.*

3d Rule, When there are any Co-efficients, divide them as in common Arithmetick, and to the Quotients annex the Quantities expreſs'd by Letters: Thus, $\frac{360\,ab}{24\,b}(=15\,a$.

4th Rule, The general Way of Diviſion of Compound Quantities, is like the ordinary Way in common Arithmetick, reſpect being had to the Rules of Algebraick Addition, Subduction, and Multiplication; as alſo, that like Signs give +, and unlike — in the Quotient, taking care to divide every Part of the Dividend by its correſponding Diviſor (*i. e.*) that whoſe Letters ſhew it of the ſame Kind with the other) to prevent a Fraction which would otherwiſe ariſe:

$$\begin{array}{l} \text{Thus } a+b)\; aa+ab-ca-cb\;(a-c. \\ \qquad\qquad aa+ab \\ \hline \qquad\qquad 0 \qquad 0-ca-cb \\ \qquad\qquad\qquad\quad -ca-cb \\ \hline \qquad\qquad\qquad\qquad 0 \end{array}$$

That the ſame Reaſon for like Signs giving a poſitive, and unlike a negative Quotient, muſt hold in Diviſion as well as in Multiplication, is clear from conſidering the Nature of Diviſion (which is only reſolving the Thing into its Parts) therefore, ſince every Dividend is nothing elſe but the Product of the Diviſor and Quotient multiplied by each other, the Quotient muſt conſiſt of ſuch Signs which could produce the Dividend; therefore if the Dividend be divided by a Quantity that hath a ſimilar Sign with it, the Quotient muſt be poſitive; if by a Quantity having a diſſimilar Sign, it muſt be Negative.

It may be a General Rule in Compound Diviſion in Algebra, always to place ſuch a Letter in the Quotient, as will, when multiplied into the Diviſor, produce the Dividend, for that is always a Rectangle under the Diviſor and the Quotient.

An Example of Compound Diviſion in Algebra.

$$\begin{array}{l} zz-16)\; z^6-8z^4-124\,zz-64\;(z^4+8zz+4 \\ \qquad\qquad z^6-16z^4 \\ \hline \qquad\qquad\qquad 8z^4-124\,zz \\ \qquad\qquad\qquad 8z^4-124\,zz \\ \hline \qquad\qquad\qquad\qquad\quad 4\,zz-64 \\ \qquad\qquad\qquad\qquad\quad 4\,zz-64 \\ \hline \qquad\qquad\qquad\qquad\qquad 0 \end{array}$$

DIVISION *in whole Numbers* is thus perform'd.

1. To divide by one Figure is very eaſy, as ſuppoſe 6759 were to be divided amongſt 3 Men, how much is each Man's Share? Set the Numbers down as you ſee here; $3)6759(2253$.

And then ſay, 3 is contained in 6 (the firſt Figure towards the Left-Hand of the Dividend) twice; wherefore I place 2 in the Quotient; then I go on to the next Figure, and ſay, 3 is found in 7 twice, and there is one over: I place 2 in the Quotient again; and I imagine the one that was over to ſtand before the next Figure 5, which will make it 15. Then I enquire how oft I can have the Diviſor 3 in 15, and finding it juſt 5 times, I place 5 in the Quotient. Then I go to the laſt Figure, and aſk how often I can have 3 in 9, which I find to be 3 times, I write 3 in the Quotient; and ſo the Operation is over, 2253 being the true Quotient, or the Number of Pounds that each Man muſt have.

2. When you are to divide a Number by a Diviſor that conſiſts of 2, 3, or more Places, the Operation is more tedious and difficult (it being indeed the hardeſt Leſſon in Arithmetick) but yet it may, with a little Practice, be readily perform'd thus; ſuppoſe 940488 Crowns were to be divided among a Ship's Company conſiſting of 263 Men, what is each Man's Share.

$$\begin{array}{l} 263)\; 940488\; (3576 \\ \qquad\; 789 \\ \hline \qquad\; 1514 \\ \qquad\; 1315 \\ \hline \qquad\quad 1998 \\ \qquad\quad 1841 \\ \hline \qquad\qquad 1578 \\ \qquad\qquad 1578 \\ \hline \qquad\qquad\quad 0 \end{array}$$

1. Set down the Numbers as you ſee; then firſt diſtinguiſh by a Point a Part of the Dividend, which ſhall be greater than, or at leaſt equal to the Diviſor, which is called the Dividual, and is firſt to be divided: Then ſeek how often you can have 263 in 940, which, becauſe it is uſually the hardeſt Task to find exactly, obſerve carefully this Rule: Firſt ſay, I can have 2, the firſt Figure of the Diviſor, 4 times in 9, the firſt of the Dividual, and there will remain 1, which 1 I imagine to ſtand before 4, the ſecond Figure of the Dividual, which

will therefore be 14; but then conſidering 6, the Figure of the Diviſor, I find I cannot have as I ought, 6 four times in 14; wherefore I conclude I cannot have 363 four times in 940: I try next then what will 3 do; and I find I can have 2 three times, and that there will remain 3, which 3 I imagine to ſtand before 4, the ſecond Figure of the Dividual, and then it will make it 34; trying therefore with 6, the ſecond Figure of the Diviſor, I find I can have 3 times in 34, and more than enough will remain to be placed before 0, the laſt Figure of the Dividual; I therefore place 3 in the Quotient juſt after the crooked Line, and by that Figure which is the

2*d* Operation, I multiply the Diviſor 263, and write the Product 789 orderly under the Dividual 940. Then,

3*dly*, I ſubtract the Product 789 from the Dividual, and there remains 151.

4*thly*, To which I bring down 4, the next Figure to the Right Hand of the Dividual, and which, to ſhew that I have done with, I mark, by putting a Point under it; ſo I have now 1514 for a new Dividual. Then do I enquire again, by the Method given in the firſt Article, how often I can have 263 in 1514, and comparing thoſe Numbers together according to that General Rule, and which a little Practice will make very eaſy, I find I can have it but 5 times; wherefore I put 5 in the Quotient, and by that multiply my Diviſor, and ſubſcribe the Product 1315 orderly under the laſt Dividual. Then I ſubtract it alſo from thence, and find a Remainder of 199; to which Remainder I bring down the next Figure 8 from the Dividend, (having alſo pointed it there) and then I have 1998 for a new Dividual; with which, as before, comparing my Diviſor 263, I find that I can have it but 7 times; wherefore placing 7 in the Quotient, by that I multiply the Diviſor 263, and ſubſcribing the Product orderly under the Dividual 1998, ſubtracting it alſo from thence; and to the Remainder, which is 157, bringing down 8, the laſt Figure of the Dividend, I have 1578 for a new Dividual; with which, comparing as before, the Diviſor 263, I find, on Trial, that I can have it juſt 6 times in it; ſo I write 6 in the Quotient: by that Figure 6 multiply the Diviſor, ſubſcribe the Product 1578 under the Dividual, and making Subtraction, find no Remainder; wherefore I conclude the Diviſion is ended, and that 3576 is the true Quotient, or Number of Crowns each Man is to have for his Share.

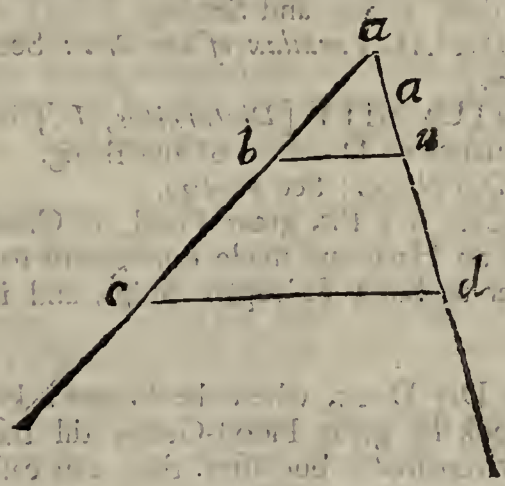
And this Example, if carefully heeded, will be ſufficient to teach any one the Way of dividing by more Figues than one; the ſeveral Operations of which Method are briefly ſumm'd up in this *Latin* Verſe,

Dic quot, multiplica, ſubduc, tranſferque ſecundum.

The only true Proof of Diviſion is by Multiplication, for the Product of the Quotient and Diviſor muſt always be equal to the Dividend: Thus, 3576 multiplied by 263, produces 940488, becauſe what is deſtroyed by Diviſion, is reſtored by Multiplication.

DIVISION *Geometrical*, or *Diviſion in Lines*, is called Application; the Deſign of which, when it is exerciſed about the Conſtruction of plain Problems, is only this, *viz.* a Rectangle being given, as alſo a Right Line, to find another Right Line, ſo that the Rectangle contained under it, and the Right Line given, ſhall be equal to the Rectangle firſt given; which Effection or Conſtruction is called the Application of a given Rectangle to a Right Line given; and the Right Line ariſing by ſuch Application is called the Parabola or Geometrical Quotient, and may be found out by the *Rule of Three*, by making, As the Line given: Is to one Side of the Rectangle :: So is the other Side: To the Line ſought.

Not unlike to which is *D. Cartes*'s Way of working Diviſion in Lines by Scale and Compaſs: Thus, ſuppoſe *a c* (=6) were to be divided by *a d* = 3, make any Angle at pleaſure, and therein ſet off firſt *a d* (= 3) the Diviſor, and then on the ſame Leg *a u* = to Unity: Then on the other Leg of the Angle ſet *a c* (=6) the Dividend, and join *d c*, and to it, through *u*, draw *u b* parallel to *d c*, which ſhall cut off *a b* the Quotient ſought; for, as *a d* : *a u* :: *a c* : *to a b*; that is, As the Diviſor: Is to Unity :: So is the Dividend: To the Quotient; on which depends the Reaſon of all Diviſion.



DIVISION *in Decimal Fractions*: See *Decimal Fractions.*

DIVISION *in Vulgar Fractions*: See *Fractions.*

DIVISION *of Logarithms*: See *Logarithms*, Nº 9.

DIVISION *of Proportion*: See *Proportion*, Nº 9.

DIVISOR [in *Arithmetick*] is the dividing Number, ſhewing how many Parts the Dividend is to be divided into.

DIVORCE, or *Devorce*, is, in the Common Law, a Separation of two Perſons actually married together, and therefore is the Solution of the *Vinculum Matrimonii*, and is not only *à Menſa*, *ſed etiam à Thoro*; and therefore a Woman thus divorced, received all again that ſhe brought with her. This is only upon a Nullity of the Marriage, upon ſome eſſential Impediment, as Conſanguinity or Affinity within the prohibited Degrees, Precontract, Impotency, or ſuch like; of which there are 14 uſually ſumm'd up in theſe Verſes by the Divines and Civilians;

Error, Conditio, Votum, Cognatio, Crimen,
Cultus, Diſparitas, Vis, Ordo, Ligamen, Honeſtas,
Si ſis Affinis; ſi forte coire nequibis;
Si Parochi & duplicis deſit præſentia Teſtis,
Rapturâ ſi ſit mulier, &c.

DIURESIS [of διά through, and ῥέω, *Gr:* to flow] is a Secretion of the Urine by the Reins, which is done after this Manner; There are little Glandules placed near the emulgent Arteries, wherewith the *Serum* is ſeparated from the Blood, and is conveyed by little Channels (of which the Subſtance of the Reins does principally conſiſt) to the *Carunculæ Papillares*, thence to the *Pelvis*, thence to the *Ureters*, thence to the Bladders, and ſo out of Doors. *Blanchard.*

DIURETICKS [διουρητικὰ, *Gr.*] are thoſe Medicines which by parting, diſſolving, and fuſing the Blood, do precipitate the *Serum* by the Reins into the Bladder. *Blanchard.*

DIURNAL *Motion of a Planet*, is ſo many Degrees and Minutes, *&c.* as any Planet moves in 24 Hours; alſo the Motion of the Earth about its Axis (in the *Copernican Syſtem*) is called its Diurnal Motion, which cauſes the Viciſſitudes of Days and Nights.

DIURNAL *Arch*, is the Arch or Number of Degrees that the Sun, Moon or Stars deſcribe between their Riſing and Setting.

DIURNAL *Parallax of the Sun*: See *Parallax* and *Sun.*

DIUTURNITY [*Diuturnitas*, *L.*] is the long Continuance or Duration of any Being.

DIZZYNESS: See *Vertigo.*

DOCK, is a Pit, great Pond or Creek by the Side of an Harbour, made convenient to work in, in order to build or repair Ships, and is of two ſorts.

1. A Dry Dock, where the Water is kept out of the Dock by great Flood-Gates, till the Ship is built or repaired; but after that, can eaſily be let in to float and launch her.

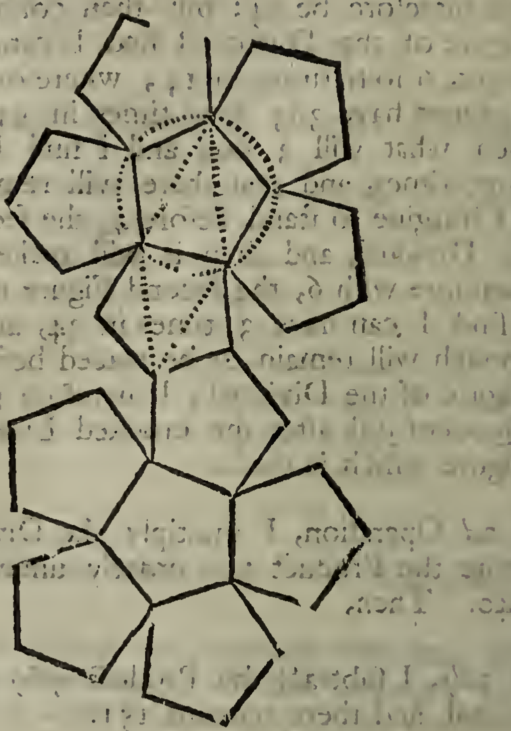
2. A Wet Dock, is any Place in the Ouze out of the Tide's way, where a Ship may be haled in, and ſo dock herſelf, or ſink herſelf a Place to lie in.

DOCKET, in the Law Senſe, is a Brief in Writing. It hath been formerly written Dogget; and ſeems then to have been ſome ſmall Piece of Paper or Parchment, containing the Effect of a larger Writing.

DODECADACTYLUM [of δώδεκα twelve, and δάκτυλος, *Gr.* a Finger] is the firſt of the ſmall Guts, beginning from the *Pylorus* of the Stomach, and ending where the Gut *Jejunum* begins: It is ſo called as if it were the Length of the twelve Fingers, which yet is never obſerved in any Men amongſt us; perhaps the Ancients miſtook, from inſpecting the Guts of ſome Brutes: 'Tis moſt uſually called *Duodenum*, *Blanchard.*

DODECAEDRON [δωδεκάεδρος, of δώδεκα and ἕδρα, *Gr.* a Side] See *Regular Bodies.* This Solid conſiſts of twelve Quinquangular Pyramids, whoſe Vertexes or Tops meet in the Center of a Sphere that is conceived to circumſcribe this Solid, and conſequently have their Baſes and Altitudes equal; wherefore, having found the Solidity of one of thoſe Pyramids, and multiplied it by the number of Baſes, (*viz.* 12.) you have the Solidity of this Dodecaedron.

The following Figure being drawn on Paſteboard, cut half through, and then folded up, will repreſent a Dodecaedron.



Its Solidity is found by multiplying the Baſe into $\frac{1}{3}$ of its Diſtance from the Center 12 times: And to find this Diſtance, take the Diſtance of two parallel Faces, the Half is the Height.

DODECAGON [of δώδεκα and γωνία, *Gr.* an Angle] a regular Polygon conſiſting of twelve equal Sides and Angles: In Fortification 'tis a Place with twelve Baſtions.

DODECATEMORY [of δώδεκα twelve, and μοῖρα, *Gr.* a Part] The twelve Signs of the Zodiack, *Aries*, *Taurus*, *&c.* are ſo called, becauſe each of them is the twelfth Part of the Zodiack.

DOG-DRAW, is one of the four Kinds of an apparent Deprehenſion of an Offender againſt Veniſon in the Foreſt: And it is, when a Man hath ſtricken or wounded a Deer, *&c.* by ſhooting at him with a Croſs-Bow, or Long-bow, or otherwiſe, and is found with a Hound or other Dog drawing after him to receive the ſame. See *Manwood's Foreſt-Laws*, *c.* 18. *N.* 9.

DOGGER, is a ſmall Ship built after the *Dutch* Faſhion, with a narrow Stern, and commonly but one Maſt. See 31 *Ed.* 3. *Stat.* 3. *c.* 1.

DOGMATICK MEDICINE, is a Rational Practice of Phyſick; *Hippocrates* was its firſt Author, and after him *Galen*; therefore thoſe Phyſicians are called Dogmatical, who, upon the Principles, as they pretend, of the School Philoſophy, reject all Medicinal Virtues that they think not reducible to manifeſt Qualities; but *Galen* hath long ago obſerved very well of ſuch Men, that they muſt either deny plain Matter of Fact, or aſſign but very poor Reaſons and Cauſes of many Effects they pretend to explain.

DOG-NAILS, are ſuch as are uſed for faſtening Hinges.

DOM-BOC: See *Domes-Day Book.*

DOME, ſo the Chymiſts call the arched Cover to their Reverberatory Furnace: See the Figure of it under that Word, or in Furnace.

DOME [in *Architecture*] is a round, vaulted or or arched Roof of a Church, or any ſuch great Building.

DOMES-DAY *Book.* When King *Alfred* divided his Kingdom into Counties, Hundreds, and Tithings, he had an Inquiſition taken of the ſeveral Diſtricts, which were digeſted into a Regiſter, which was called *Dom-Boc*, *i. e.* the Judicial or Judgment Book, repoſited in the Church of *Wincheſter*, and thence call'd the *Wincheſter-Book*, to which King *Edward*, *Sen.* ſeems to refer in the firſt Chapter of his Laws. The General Survey taken afterwards by *William* the Conqueror was after this Precedent of King *Alfred*, and ſeems but a Corruption of, or rather an Addition to, the ſame Name, *Dom-Boc* into *Domes-Day Book*: And it implying no more than *Doom-Book*, or a Regiſter from which Sentence might be given in the Tenure of Eſtates; (whence by *Latin* Writers 'tis called *Liber Judicialis*) 'tis a trifling Etymology to derive the Word from *Domus Dei*, or *Domes-Day*, that is, the final Day of Judgment. And it is not improper to obſerve (becauſe no Notice hath yet been taken of ſo ſmall a Matter) that the Addition of *Dey*, or *Day*, in forming *Domes-Day Book* from *Dom-Boc*, doth not augment the Senſe of the Word, but only doubles and confirms it. For the Word *Day*, in all Idioms, ſignifies Judgment: And in the North, to this Day, a *Dayſman* is an Arbitrator, Umpire, or Judge; and ſo 'tis tranſlated in our *Engliſh* Bible, in *Job* ix. 33. *Domes-Day Book* therefore is no more than the Book of *Judicial Verdict*, *Decretory Sentence*, or *Dooming of Judgment*. *Kennet*'s *Paroch Antiq. in Gloſſ.*

DOMIFYING [in *Aſtrology*] is the dividing or diſtributing the Heavens into twelve Houſes, in erecting a Scheme or Horoſcope, by means of ſix great Circles, call'd *Circles of Poſition*.

DOMINICAL LETTER, one of the firſt ſeven Letters of the Alphabet, wherewith the Sundays are mark'd throughout the Year in the Almanack.

To find the Dominical Letter.

Divide the Year, its 4th, and 4 by 7. what's left ſubtract from 7, the Letters given, A 1, B 2, C 3, D 4, E 5, F 6, G 7.

Example.

In the Year	1731
The 4th Part, omitting Fractions, is	432
To both which add the Number	4
The Sum is	2167

Which Sum divided by 7, leaves 4 remaining, and 4 from 7 leaves 3, which ſhews the Dominical Letter for the Year 1731, is the Third in the Order of the Alphabet, that is, C.

DOMINICUM, *Demain*, or *Demeſne*, are Lands not rented to Tenants, but held in *Demeſne*, or in the Lord's own Uſe and Occupation. *L.*

DOMO REPARANDA, is a Writ for one againſt his Neighbour, by the Fall of whoſe Houſe he feareth Hurt to his own. *L.*

DONATIVES. See *Benefices*.

DONEE [in *Law*] he to whom Lands, *&c.* are given.

DONJON [in *Fortification*] is generally taken for a large Tower or Redoubt of a Fortreſs, where the Gariſon may retreat in caſe of Neceſſity, and capitulate with greater Advantage.

DONOR [in *Law*] he who gives Lands or Tenements in Tail.

DORICK *Order of Architecture*, was invented by the *Dorians*, a People of *Greece*, whence the Name. If its Columns are ſimple and plain without Pilaſters; *Palladio* ſaith they ought to be 7 Modules and one Half, or 8 Modules high. The Intercolumniations are to be little leſs than 3 Diameters of the Column: And this Manner of Building is by *Vitruvius* called *Diaſtyle*.

But if the Columns have Pilaſters, their Height, reckoning Baſe and Chapiter, muſt be 17 Modules and $\frac{1}{3}$; and by the by, though the Module in all the other Pillars be a Diameter divided into 60 equal Parts, yet in this Order the Module is to be accounted but as the Semi-diameter, and is therefore of 30 ſuch Parts, according to *Palladio*.

This Pillar hath no proper Baſe, which is the Reaſon that moſtly in the Ancient Buildings you ſee them without any Baſe at all, as in *Marcellus* his Temple at *Rome*, *&c.*

But when the Attick Baſe is given it, it much augments its Beauty, and then the Height of the Baſe is to be $\frac{1}{2}$ the Diameter of the Column.

The Capital's Height alſo ought to be half the Diameter of the Pillar at the Baſe, and the Architrave the ſame Height. The *Freeſe* is a Module and $\frac{1}{2}$ Height, and the *Cornice* is a Module and $\frac{1}{3}$. The *Triglyph* is one Module, and its *Capital* the 6th Part of one; the *Metops* or Space between *Triglyph* and *Triglyph*, is in Length the ſame with the Height of the *Triglyph*.

This Order being deſigned to repreſent Solidity to us, ought not to be uſed but in great and maſſy Buildings, as the Outſide of Churches and publick Places.

The Entablature here is more Maſſy and Tall than in the other Order, becauſe the Strength of the Column is ſo much greater, it being uſually $\frac{1}{4}$ of the Column. The *Cornice* muſt be without any Foliage or Trimming, and if you allow *Modillions*, they muſt be Square and Plain.

The *Freeſe* here hath a regular Ornament, which are the *Triglyphs*; the *Metops* or Space between which ſhould be exactly Square.

The Architrave of this Pillar hath alſo a peculiar Ornament, which are certain Pendulous Drops under the *Triglyphs*, which yet ſeem as it were to be faſtened to it.

DORMANT, is the Herald's Term for the Poſture of a Lion borne ſleeping, in any Coat of Arms.

DORMANT *Tree*, is a Word uſed in Architecture, by ſome Workmen, for a great Beam lying a-croſs the Houſe, which is uſually called a *Summer*.

DORMER [in *Architecture*] is a Window made in the Roof of an Houſe, and it ſtands upon the Rafters.

DORSI LONGISSIMUS, is a Muſcle which ariſes in common with the *Sacrolumbalis* from the Spine of the *Os Ilium*, and the ſuperior Part of the *Sacrum*, and all the Spines of the *Vertebræ* of the Loins, externally tendinous, internally fleſhy: In its Aſcent it is inſerted to the Tranſverſe Proceſſes of the *Vertebræ* of the Loins, and as it marches over the laſt Rib this great Muſcle divides itſelf into two, the outermoſt of which is the *Sacrolumbalis*, but the innermoſt next to the Spine is the *Longiſſimus Dorſi*, which aſcends with a partly fleſhy and partly tendinous Outſide, and Fibres paſſing ſomewhat obliquely outward; Part of which tendinous Fibres ariſe diſtinct from the inferior Spines of the *Vertebræ* of the *Thorax*, and ſuperior of the Loins, from which ariſe ſome fleſhy Fibres aſcending obliquely inwards, and are inſerted to the fifth, ſixth, and ſeventh Spine of the *Thorax*, as expreſt by *Bidloo*, and called *Semi-Spinalis*. The other larger Part of this Muſcle aſcending on the *Thorax*, divides itſelf into many diſtinct fleſhy Portions, not much unlike a Palm Branch, which are inſerted in a twofold Manner to the Tranſverſe Proceſs of each *Vertebra* of the *Thorax* and Tubercle of each Rib, as alſo to the tranſverſe Proceſſes of the *Vertebræ* of the Neck.

When this and its Partner acts, they are not only ſerviceable in keeping the Trunk of the Body erect, and bending it backwards, but they are alſo uſeful in Progreſſion, as it may be obſerved when either Leg is moved forwards, this Muſcle on the ſame Side is in Action, which ſeemeth to be advantageous in rendring the *Os Ilium* at that time ſtable, ſo that the Thigh may be the more commodiouſly elevated, in regard it is ſo moved by a Muſcle ariſing from the *Vertebræ* above the *Os Ilium*, namely the *Pſoas. L.*

DORSUM, or *Tergum*, the Back, is the hinder Part of the *Thorax*; but the *Dorſum* of the Hand or Foot is their Outſide. *Blanchard.*

DORSIPAROUS, and *Dorſiferous Plants* [of *dorſum* the Back, and *pario* to bring forth, and *fero*, *L.* to bear] are ſuch as are of the Capillary kinds without Stalks, and bearing their Seeds on the Backſides of their Leaves: Theſe are called by ſome Botaniſts *Epiphylloſpermæ*; and by others, *Hypophylloſpermæ*: See *Capillary Plants.*

DOSE, is a ſet Quantity of Phyſick, being uſually as much as is given at once.

DOTE ASSIGNANDA, is a Writ that lies for a Widow, where it is found by Office that the King's Tenant was ſeized of Tenements in Fee or Fee-Tail at the Day of his Death, &c. and that he holdeth of the King in chief, &c. for in this Caſe the Widow cometh into the Chancery, and there maketh Oath that ſhe will not marry without the King's Leave, and hereupon ſhe ſhall have this Writ to the Eſcheator. *L.*

And this ſort of Widow is called the King's Widow.

DOTE *unde nihil habet*, is a Writ of Dower that lieth for the Widow againſt the Tenant which bought Land of her Husband in his Life-time, whereof he was ſeized ſolely in Fee-Simple or Fee-Tail, in ſuch ſort as the Iſſue of them both might have inherited it. *L.*

DOUBLE-DESCANT: See *Deſcant.*

DOUBLE *Horizontal Dial*, invented by Mr. *Oughtred*, and made of Braſs with a double *Gnomon*, one to ſhew the ſame Hour on the Stereographick Projection (drawn on the Plate.) This not only finds the Meridian, Hour, &c. but ſhews the Sun's Place, Riſing and Setting, Declination, Amplitude, Altitude, and Azimuth, Diurnal Arch, and many uſeful Propoſitions; and may be very well applied to the making of Dials.

DOUBLE or *Flank'd Tenaille*: See *Tenaille.*

DOUBLE-PLEA [in *Law*] is that wherein the Defendant alledgeth for himſelf two ſeveral Matters in Bar for the Action, whereof either is ſufficient to effect his Deſire in debarring the Plaintiff. And this is not to be admitted in the Common Law, wherefore it is well to be obſerved when a Plea is double, and when not, for if a Man alledge ſeveral Matters, the one depending nothing on the other, the Plea is accounted double; if they be mutually depending one on another, then it is accounted but ſingle.

DOUBLE *Quarrel*, is a Complaint made by any Clerk or other to the Archbiſhop of the Province againſt an inferior Ordinary, for his delaying of Juſtice in ſome Cauſe Eccleſiaſtical; as to give Sentence, to inſtitute a Clerk preſented, &c. The Effect whereof is, that the Archbiſhop taking Knowledge of the Delay, directs his Letters, under his Authentick Seal, to all and ſingular Clerks in his Province, thereby commanding and authorizing them, and every of them, to admoniſh the ſaid Ordinary, within a certain Number of Days, (*viz.* 9.) to do the Juſtice required; or otherwiſe to cite him to appear before him or his Official, at a Day in the ſaid Letters prefixed, and there to alledge the Cauſe of this ſaid Delay. And laſtly, to intimate to the Ordinary, that if he neither perform the Thing enjoined, nor appear at the Day aſſign'd, he himſelf will, without further Delay, proceed to perform the Juſtice required. And this ſeems to take its Name of *Duplex Querela*, from its being moſt times made both againſt the Judge, and him at whoſe Petition Juſtice is delayed. *Cowel's Interpreter.*

DOUBLE *Aſpect*, a Term in Painting. See *Aſpect Double.*

DOUBLE *Point.* When all the Right Lines tending the ſame Way, with the infinite Leg of any Curve, do cut it in one only Point (as happens in the Ordinates of the *Carteſian*, and in the *Cubical Parabola*, and in the Right Lines, which are parallel to the Abſciſſæ of Hyperboliſm-Hyperbola's and Parabola's) then you are to conceive, that thoſe Right Lines paſs thro' two other Points of the Curve (as I may ſay) placed at an infinite Diſtance. And thoſe coincident Interſections, whether they be at a finite or at an infinite Diſtance, Sir *Iſaac Newton* calls the Double Point: And how ſuch Curves as have a Double Point are deſcrib'd, ſee under *Curves.*

DOUBLE-VESSEL [in *Chymiſtry*] is when the Neck of one Bolt-head or Matraſs is put and well luted into the Neck of another; and this is uſed for the Circulation of Spirits, in order to their being exalted and refined as high as can be: See *Matraſs.* Of this there are ſeveral Figures; 'tis ſometimes called a *Pellican*, and alſo *Diota.*

DOUBLING the Cape or a Point of Land [in *Navigation*] ſignifies to come up with it, paſs by it, and ſo to leave it behind the Ship.

DOUBLING, in a Miltary Senſe, is to put two Ranks or Files of Soldiers into one, ſo that when the Word of Command is *Double your Ranks*, then the 2d, 4th and 6th Ranks are to march up into the 1ſt, 3d and 5th, ſo that of 6 Ranks they make but 3, leaving double the Interval there was between them before, which is not ſo when they double the half Files, becauſe then 3 Ranks ſtand together, and the 3 others come up to double them; that is, the 1, 2 and 3 are doubled by the 4, 5 and 6th, or on the contrary. *Double your Files*, is for each other to march to that next to it on the Right or Left, according to the Word of Command, and then the 6 Ranks are turned into 12, the Men ſtanding 12 deep, the Diſtance between the Files being now double of what it was before.

DOUCINE [in *Architecture*] is an Ornament of the higheſt Part of the *Cornice*, or a Moulding cut in Form of a Wave, half Convex and half Concave.

DOVE-TAILING [in *Architecture*] is a Way of faſtening Boards or Timber together, by letting one Piece into another indentedly, with a Dove-tail Joint, or with a Joint in the Form of a Dove's Tail.

DOWER [in *Common Law*] ſignifies that which the Wife bringeth to her Husband in Marriage, called by ſome *Maritagium*; but it is taken moſt commonly for that which ſhe hath of her Husband after the Marriage is determined, if ſhe out-live him, and this is the third Part of all the Lands of which the Husband was in his Life-time actually ſeized, in an Eſtate of Fee-Simple or Fee-tail.

DOWER, by Cuſtom, in ſome Places, gives the Wife half her Husband's Goods, ſo long as ſhe lives ſingle, as in Gavel-kind.

DOWER *de la plus belle*, by this ſhe is endowed with the beſt and faireſt of her Husband's Eſtate.

DOWNS, an Elevation of Stones and Sands, which the Sea forms along its Banks, and ſerves it as a Barrier; theſe are often famous for a Road for Ships.

DRACO VOLANS, with the Meteorologiſts, is a Fat, Heterogeneous, Earthy Meteor, appearing long and ſinous, ſomething in the Shape of a flying Dragon; and this Shape they will have to ariſe from the latter Part of the Matter of this Meteor, being fired with greater Impetuoſity than what comes firſt out of the Cloud; and they ſuppoſe the broken Parts of the Cloud, and the Sulphureous Matter which adheres to them, forms the apparent Wings of this imaginary Dragon.

DRACONTICK *Month* [in *Aſtronomy*] the Space of Time wherein the Moon going from her aſcending Node call'd *Caput Draconis* returns to the ſame.

DRACUNCULUS, is an Ulcer which eats thro' even a Nerve itſelf. *Blanchard.*

DRAGONNEE [in *Heraldry*] as a *Lion Dragonnee* is where the upper Part reſembles a Lion, and the other Half going off like the hind Part of a Dragon.

DRAGON'S *Head* and *Tail*, or the Nodes of the Moon, in Aſtronomy, are two Points where the Orbit of the Moon, which makes with it Angles of 5 Degrees, cuts the Orbit of the Sun at the Ecliptick, the one of them tends Northwards, the Moon being there to have North Latitude, and the other Southwards, where ſhe commences South. This her Deviation from the Ecliptick ſeems, according to ſome Men's Fancy, to make a Figure like to that of a Dragon, whoſe Belly is where he has the greateſt Latitude, and the Interſections repreſent the Head and Tail; from which Reſemblance 'tis ſo called.

But *Note*, Theſe Points abide not always in one Place, but have a Motion of their own in the Zodiack, and retrograde almoſt 3 Minutes a Day, and compleat their Circle in about 19 Years; ſo that the Moon can be but twice in the Ecliptick during her menſtrual Period, but at all other times will have Latitude as they call it.

DRAGON *Beams* [in *Architecture*] are two ſtrong Braces, or Struts, which ſtand under a Breaſt-Summer, and meet in an Angle on the Shoulder of the King-piece.

DRAGS in a Ship, are by the Seamen accounted whatever hangs over the Ship in the Sea, or is towed after the Ship in the Water, *&c.* Such as Cloches, a Boat, *&c.*

DRAPERY [ſignifies in *Painting* or *Sculpture*] the Cloathing of any Human Figures, and when the Folds of Garments hang eaſy and natural, and yet appear ſtrong, we ſay the Drapery is very good.

DRASTICK *Compaſſes*, are Compaſſes with ſeveral moveable Points to draw fine Draughts of Charts, Maps, Architecture, Fortification, Dialling, *&c.*

DRAUGHT-*Hooks*, are large Iron Hooks fixt on the Cheeks of a Cannon Carriage, two on each Side, one near the Trunnion Hole, and the other at the Train. Large Guns have Draught-hooks near the middle Tranſum, to which are fix'd the Chains which ſerve to eaſe the Shafts of the Limbers on a March.

DRAUGHT, DRAFT [in *Architecture*] the Figure of an intended Building, deſcribed on Paper; wherein, by Scale and Compaſs, are laid down the ſeveral Diviſions and Partitions of the Apartments, Rooms, Doors, Paſſages, Conveniencies, *&c.* in their due Proportion.

DRAW, a Ship is ſaid to draw ſo much Water, according to the Number of Feet ſhe ſinks into it: Thus, if fifteen Foot from the Bottom of her be under Water, or if ſhe ſink into the Water fifteen Foot perpendicular, ſhe is ſaid to draw fifteen Foot Water: According as ſhe draws more or leſs Water, ſhe is ſaid to be of more or leſs Draught.

A DRAW-BACK [in *Commerce*] a Rebate or Diſcount upon the Price of Commodities purchas'd on certain Conditions; alſo a Repayment of Money paid to an Importer of ſome Part or the whole Cuſtom paid for importing Goods, on Condition of his exporting them again.

DRAW-BRIDGE, is a Bridge made after the Manner of a Floor, to be drawn up or let down (as Occaſion ſerves) before the Gate of a Town or Caſtle.

Draw-Bridges are made after ſeveral Faſhions, but the moſt common are made with Plyers twice the Length of the Gate, and a Foot in Diameter: The inner Square is travers'd with a St. *Andrew's* Croſs, which ſerves for a Counterpoiſe, and the Chains which hang from the other Extremities of the Plyers, to lift up or let down the Bridge, are of Iron or Braſs.

DRAWING *Medicines*: See *Epiſpaſtick.*

DRENCHES, or *Drenges,* (*Lat. Drengi*) ſome ancient MSS. ſay, were Tenants *in Capite*: Such as at the Conqueſt being put out of their Eſtates, were afterwards reſtor'd by King *William*, becauſe they being Owners thereof, were neither againſt him by their Perſons or Councils. *Coke* on *Lit. Fol.* 6. ſays, theſe Drenches are Free Tenants of a Manor.

DRENGAGE, was the Tenure by which the Drenches held their Lands.

DRIFT-SAIL, in a Ship, is a Sail uſed under Water; its veered out right a-head upon the Sea in a Storm, having Sheets faſtned to it as other Sails have, its Uſe being to keep the Ship's Head right upon the Sea: It is alſo uſeful to hinder a Ship's driving with a Current, and ſo generally uſed by Fiſhermen, eſpecially in the North Seas.

DRIFT *of the Foreſt*, an exact View or Examination of what Cattle are in the Foreſt, that it may be known, whether it be overcharged or not, and whoſe Beaſts they are; and whether they are commonable Beaſts or not.

DRIFT-WAY of a Ship, the ſame with *Lee-way.*

DRIP [in *Architecture*: See *Larmier.*

DRIPS [in *Architecture*] a kind of Steps on flat Roofs to walk upon; a way of Building much uſed in *Italy*, where the Roof is not made quite flat, but raiſed in the Middle.

DROPS [in *Architecture*] the ſame with *Guttæ*, which ſee.

DROPS [in] *Meteorology*] The Spherical Form into which the Drops of Fluids conform themſelves, is a Phœnomenon that has caus'd ſome Perplexity to the Philoſophers.

The Solution they gave, is, that the equable, uniform Preſſure of the ambient or incumbent Atmoſphere cloſed them into that Form; but this Solution will not now ſatisfy, ſince it has been found that the Phœnomenon holds *in vacuo*, as well as in Air.

Thoſe who adhere to the *Newtonian* Philoſophy aſcribe this Phœnomenon to their Attraction, which being greater between the ſeveral Particles of Fluids than between them and thoſe of the Medium, they are as it were concentrated, and brought as near each other, and into as little Compaſs as may be, which cannot be without their being Spherical.

Accordingly, Sir *Iſaac Newton* writes thus. *Guttæ enim Corporis cujuſve Fluvii, ut Figuram globoſam inducere conentur, facit mutua Partium ſuarum Attractio; eodem modo quo Terra Mariaque in Rotunditatem undique conglobantur, Partium ſuarum Attractione mutua, quæ eſt Gravitas.* Opt. p. 338.

DROPSY: See *Hydrops.*

DRY *Moat*: See *Moat.*

DUCES TECUM, is a Writ commanding one to appear at a Day in the Chancery, and to bring with him ſome Evidence, or other Thing, that the Court would view. There is another kind of *Duces Tecum* directed to the Sheriff, upon return that he cannot bring his Priſoner without danger of Death, he being *adeo Languidus*; then the Court grants a *Habeas Corpus* in the Nature of a *Duces tecum licet Languidus.* L.

DUCKUP, a Word uſed at Sea by the Steerſman, or he that is at Helm, when either Mainſail, Fore-ſail, or Sprit-ſail hinder his Sight ſo, that he cannot ſee to ſteer by a Land-Mark or the like, for then his Word is Duckup the Clew Lines of thoſe Sails: And as to the Sprit-ſail, when a Shot is to be made by a Chaſe Piece, and the Clew of that Sail hinders the Sight, they ſay, Duckup the Clew Lines of the Sprit-ſail; that is, hale the Sail out of the Way.

DUCTILITY, is an eaſy yielding Extenſion and Spreading of the Parts of any Metal under the Hammer, *&c.* and this is moſt remarkably the Property of Gold, whoſe Ductility is ſo great, as to be really wonderful; for Mr. *Rohault* tells us, that Gold Beaters of one Ounce of Gold make 2790 ſquare Leaves of Gold, each containing two Inches and ten Lines; and by deducting the Waſtes that are cut off (which amounts to near one half of it) the Surface of every Leaf of Gold will be found to contain 1156 ſquare Lines; ſo that all of them joined together Side by Side, will make a Surface of 3155880 ſquare Lines. And if the third Part be added to this, as a Conſideration for the Loſs in the making, 'twill follow, that Gold-Beaters, out of one Ounce of Gold, beat 4270840 ſquare Lines.

Captain *Halley*, in *Philoſoph. Tranſ.* N. 194, gives this further Account of the extreme Ductility, and exceeding Minuteneſs of the Parts of Gold. 'Tis evident, that Gravity is in all Bodies proportional to the Quantity of Matter in each; this is known by undoubted Experiment, ſo that there is no ſuch Thing as a Propenſion of ſome more, others leſs, towards the Earth's Centre, ſince the Impediment of the Air being remov'd, all Bodies deſcend, be they never ſo looſe or compact in Texture, with equal Velocity. It follows therefore, that there is 7 times as much Matter in a Piece of Gold, as in one of Glaſs of the ſame Magnitude, (their ſpecifick Gravities being as 7 to 1 nearly) and conſequently, that at leaſt 6 Parts in 7 of the Bulk of the Glaſs muſt be Pore or Vacuity. This ſome Favourers of the Atomical Philoſophy have endeavour'd to ſolve, by ſuppoſing the Primary or Conſtituent Atoms of Gold to be much larger than thoſe of other Bodies, and conſequently the Pores fewer. In order to examine this, he inform'd himſelf by the Wire-drawers, that every beſt double-gilt Wire was made out of Cylindrick Ingots of Silver, four Inches in Circumference, and 28 Inches long, weighing 16 *lb.* Troy. To gild theſe, they beſtow 4 *oz.* of Gold; that is, to every 48 *oz.* of Silver, one of Gold. They inform'd him alſo, that two Yards of ſuperfine Wire weighs juſt one Grain. Hence at firſt Sight it appear'd, that the Length of 98 Yards of Wire is in Weight 49 Grains, and that a ſingle Grain of Gold covers the ſaid 98 Yards; and further, that the 10000th Part of a Grain is above one 3d of an Inch in Length, (or longer than a Barley-Corn) which Length may actually be divided into 10 Parts, and conſequently the 100000th Part of a Grain of Gold be viſible without a Microſcope. And by reaſon of the Specifick Gravities of the Metals, *viz.* Silver $10\frac{1}{3}$, and Gold $18\frac{1}{3}$; he found the Diameter of ſuch Wire to be $\frac{1}{186}$th Part of an Inch, and its Circumference $\frac{1}{123}$d Part of an Inch; but the Gold did not exceed in Thickneſs $\frac{1}{134500}$th Part of an Inch. Whence it may be concluded, that the Cube of an hundredth Part of an Inch would contain above 2433000000 (or the Cube of 1345) ſuch Atoms. And yet tho' the Gold be ſtretch'd to ſuch a prodigious Degree as is here demonſtrated, it ſtill ſhews itſelf of ſo even and united a Texture, as not to let the white Colour of the Silver that lies under it appear (even by a Microſcope) thro' any the leaſt Pores. Which argues, that even in this exceeding Thinneſs, very many of thoſe Atoms may ſtill lie one over the other.

DUCTUS ADIPOSI: See *Sacculi Adipoſi.*

DUCTUS ALIMENTALIS, ſo our moſt accurate Anatomiſt Dr. *Tyſon* calls the *Gula,* Stomach and Inteſtines, all which make but one continued Canal or Duct: And this *Ductus* he very truly makes the proper Characteriſtick of an Animal, or, as the Schools would expreſs it, the *Proprium Quarto Modo,* for all Animals have this Duct, and none but Animals.

DUCTUS BILARIUS: See *Porus Bilarius.*

DUCTUS HEPATICUS; this and the *Ductus Cyſticus* together make the *Ductus Communis Choledocus,* which goes obliquely to the lower End of the *Duodenum,* or Beginning of the *Jejunum,* and after it hath pierced the firſt Coat, it runs near two Fingers Breadth between the Coat before it opens into the Cavity of the Inteſtine, which oblique Inſertion ſerves inſtead of a Valve to hinder the Return of the Bile into it again.

DUCTUS CHYLIFERUS, is a Veſſel, in the lower Part whereof, called the *Receptaculum Chyli,* all the Lacteal Veins, and many Lymphæducts, are terminated. It ariſes about the Kidney on the Left Side, and aſcending along the *Thorax* near the great Artery, ends at the Subclavian Vein on the Left Side. It is furniſhed with ſeveral Valves, that the Matter which aſcends by it may not fall down again betwixt the fourth and ſixth *Vertebræ*: It is variouſly forked or divided. It's Uſe is to convey the Chyle and *Lympha* from the lower Parts to the Heart. This Duct is alſo ſometimes called the *Ductus Communis Lympharum,* becauſe the Lymphatick Veſſels diſcharge themſelves into it, and very uſually *Ductus Thoracicus.*

DUCTUS CYSTICUS, is a Pipe going from the Neck of the Gall Bladder to that Part where the *Porus Bilarius* joins it; 'tis of the Bigneſs of a Gooſe Quill; it goes not in a ſtraight Line, but as it were depreſt by the Liver; ſeveral ſmall Bilary Ducts open into it, and its inner Membrane hath many Wrinkles, which retard the Motion of the Bile. *L.*

DUCTUS PANCREATICUS, is a little Channel which ariſes from the *Pancreas* or Sweet-bread, running all along the Middle of it, and is inſerted into the *Duodenum*, near, or not far off, the Paſſage which conveys the Bile: It carries a Juice, which it diſcharges into the *Duodenum*, to ferment and volatilize the Meat from the Acid Ferment of the Stomach and the Mixture of the Gall. The Learned Dr. *Graaf* got a Juice of it that was ſomething acid; though others doubt of it, and of many Diſeaſes which *Silvius* attributes to the Efferveſcency of this acid pancreatick Juice with the Gall in the *Duodenum*. However, there is ſometimes an acid Juice found in it, and often a ſalt and auſtere, but frequently an inſipid Liquor. This Canal was firſt found by *Virtſungus*, and is frequently from him called the *Ductus Virtſungianus*. L.

DUCTUS RORIFERUS, (ſo the Noble *Bilſius* calls it) the ſame with *Ductus Chyliferus*. L.

DUCTUS SALIVARES, or *Salivarii*, are Paſſages which proceeding from the *Maxillary Glandules* or *Parotides*, go as far as the Jaws and Sides of the Tongue, where they emit the Juice we call Spittle, which conduces to the better chewing and ſwallowing of ſolid Meat, and much to its Fermentation too. *Steno* was the firſt who diſcovered the *Ductus Salivaris exterior*, as he tells us in his Book *de Muſculis*.

DUCTUS THORACIUS: See *Ductus Chyliferus*.

DUCTUS UMBILICALIS: See *Funiculus*.

DUCTUS URINARIUS: See *Ureters*.

DUELLISTS, ſo Mr. *Boyle* calls the two Principles of thoſe Chymical Philoſophers, who will needs explicate all the *Phænomena* of Nature from the Doctrine of *Alkali* and *Acid*, and the ſuppoſed Hoſtility that there is between them, ſo that whenever they meet, they do as it were engage and fight a Phyſical Duel.

DULCIFIED *Spirit of Sal Armoniack*: See in *Volatile Spirit of Sal Armoniack*.

DULCIFY, when equal Parts of Spirit of Wine, and any acid Menſtruum, ſuch as Spirit of Salt, Nitre Vitriol, *&c.* are digeſted together for 3 or 4 Days Time, the Chymiſts call it Dulcifying the Acid Spirit; and after that 'tis called *Spiritus Salis, Nitri, Vitrioli Dulcis, &c.*

DULEDGE [in *Gunnery*] is a Peg of Wood, which joins the Ends of the 6 Fellows, which form the Round of the Wheel of a Gun-Carriage; and the Joint is ſtrengthen'd on the Outſide of the Wheel by a ſtrong Plate of Iron call'd the *Duledge Plate*.

DUM *fuit infra ætatem*, is a Writ which lies for him that before he came to his full Age, made a Feoffment of his Land in Fee, or for Term of Life, or in Tail, to recover them again from him to whom he conveyed them.

DUM *non fuit compos mentis*, is a Writ that lieth againſt the Alienee or Leſſee, for him that not being of ſound Memory, did alien any Lands or Tenements in Fee-Simple, or for Term of Life, Fee-Tail, or for Term of Years.

DUODENUM, is the firſt of the Inteſtines or Guts, and is about 12 Fingers Breadth long; 'tis continued to the *Pylorus*, from which turning downwards, it runs under the Stomach immediately above the *Vertebræ* towards the Left Side, and ends at the firſt of the Windings under the Colon: At its lower End there are two Pipes or Canals which open into its Cavity, one from the Liver and Gall-Bladder called the *Ductus Choledocus Communis*, the other, from the *Pancreas*, called the *Ductus Pancreaticus*. This Inteſtine differs from the *Jejunum* and *Ileum*, in that its Paſſage is ſtraighter, and its Coats are thicker.

DUPLEX *Querela*: See *Double Quarrel*.

DUPLICATE, is uſed by *Crompton* for Second Letters Patents granted by the Lord Chancellor in a Caſe wherein he had formerly done the ſame, and was therefore thought void. But any Tranſcript or Copy of a Writing may be call'd a Duplicate.

DUPLICATE-PROPORTION, or *Ratio*, muſt be well diſtinguiſh'd from *Double*: In a Series of *Geometrical Proportionals*, the firſt Term to the third is ſaid to be a Duplicate Ratio of the firſt to the ſecond, or as its Square is to the Square of the ſecond: Thus in 2, 4, 8, 16, the Ratio of 2 to 8 is Duplicate of that of 2 to 4, or as the Square of 2 to the Square of 4; wherefore Duplicate Ratio is the Proportion of Squares, as Triplicate is of Cubes, *&c.* and the Ratio of 2 to 8 is ſaid to be compounded of that of 2 to 4, and of 4 to 8.

DUPLICATION, is the doubling of any thing, or multiplying of it by 2; alſo the folding of any thing back again on itſelf.

DURABLE-FORTIFICATION: See *Fortification*.

DURA MATER: See *Mater Dura*.

DURATION, is the Idea which we have of the Continuation of the Exiſtence of any thing, and is the ſame thing with Time, when this is mathematically and abſolutely conſidered; but the vulgar Time is the Meaſure of this Duration taken from the Motion of the Heavenly Bodies, *&c.*

Mr. *Lock* defines Duration to be the Idea which we have of periſhing Diſtance, of which no two Parts exiſt together.

DURESSE, a Term in Law, ſignifying a Plea uſed by way of Exception by him, that being caſt into Priſon at a Man's Suit, or otherwiſe by Beating or Threats hardly uſed, doth unwillingly ſeal unto him a Bond during his Reſtraint; for the Law holdeth ſuch Specialty void, but rather ſuppoſeth it to be by Conſtraint, and Dureſſe pleaded ſhall avoid the Action.

DYALLING, is the Art of deſcribing Hour-lines truly on any given Plane, ſo as thereby to ſhew the Hour of the Day when the Sun ſhines.

It is founded on this Suppoſition, That the whole Earth is but a Point in compariſon of the *Magnus Orbis*, or the Sphere of the Sun's Motion round it (or of it round the Sun;) and therefore the Hour Lines drawn on any Plane, are in Effect the ſame with thoſe right Lines produced by the mutual Interſection of a great Circle of the Sphere, parallel to the Plane of the Dyal, and to the Planes of the ſeveral Hour Circles.

For the Plane of every Dyal is parallel to ſome greater Circle of the Sphere, which is far from the Plane of the Dyal, as is the Point aſſigned for the Apex or Point of the Style.

The Situation therefore of the Plane is the firſt thing to be conſidered, and this, properly ſpeaking, is only in reſpect of the Horizon or the Meridian.

In Reference to the Horizon, if the Plane is exactly parallel to it, it is called properly an Horizontal Plane, and the Dyal drawn on it an Horizontal Dyal.

If the Plane be perpendicular to the Horizon, as all thoſe of Walls are ſuppoſed to be, the Dyal deſcribed on it is called an Erect mural Dyal: If the Plane be oblique to the Horizon, it either hangs over towards you, making an acute Angle with it, and then it is called a Reclining Plane; and if it recline back equal to the Complement of the Latitude of the Place, it lies in the Plane of the Equinoctial, and is called therefore an Equinoctial Dyal.

In reſpect of the Meridian, a Plane is either Direct or Declining. The Plane of a Dyal is Direct, when it reſpects one of the 4 Cardinal Points Directly, or when 'tis either parallel to the Meridian, as are all direct Eaſt or Weſt Dyals, (which therefore are properly called Meridional) or perpendicular to it, as are all Direct, Erect North and South Dyals, which, becauſe they lie in the Plane of the Prime Verticle Circle, are rightly called Vertical Dyals by moſt Authors.

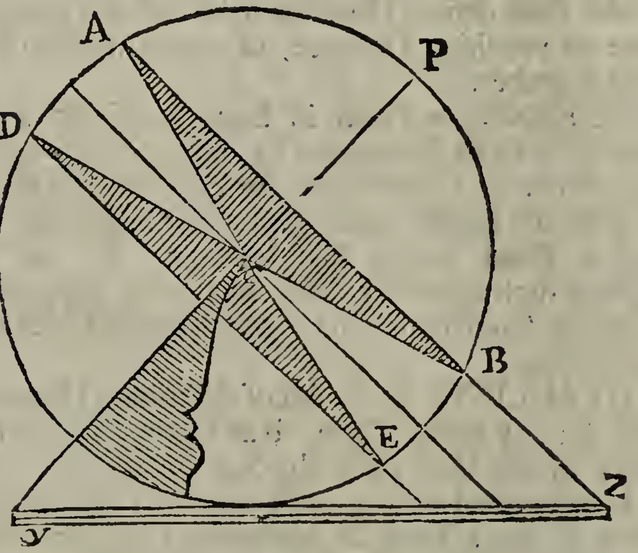
The Plane of a Dyal is Declining, when it is not directly oppoſite to to any of the four Cardinal Points, but declines or deviates ſome way from the Meridian or Prime Verticle Circle.

The Fundamental Scheme for Dyalling, is the Projection of the Sphere on the Plane of any particular Horizon, which you will find how to make under the Word Projection.

To find upon any Dyal whether the Parallels of the Sun's Courſes, &c. will be Parabola's, Hyperbola's, Ellipſes or Circles.

The Stile of a Dyal being look'd upon as the Earth's Axis, therefore upon any Point thereof (as *c*) which being deſigned for the Point to trace the Parallel by, project the Sphere.

Then the Sun being in any of the Parallels of Declination, for Inſtance, as AB the Tropick of Cancer, will caſt the Shadow of the Point *c* (the Earth's Center) in a ſtraight Line, ſo that when the Sun hath performed one Diurnal Revolution, the Shadow of the Point doth trace a conical Surface DCE, whoſe Vertex is C, and is ſimilar to the Cone ABC: Now the Lines CD, CE, CA, CB of theſe Cones, may be conceived to be infinitely extended.



1. Then, whatever Plane is parallel to the Baſe of the Cone DE or AB, the Shadow of the Point *c* will deſcribe upon that Plane a Circle.

2. If any Plane cut either of theſe Cones parallel to either of the Sides, the Shadow of the Point C will deſcribe upon that Plain a Parabola.

3. If a Plane cut the Cone, and likewiſe one of its Sides produced beyond the Vertex, the Shadow of the Point *c* will deſcribe upon that Plane an Hyperbola.

As here the Plane AB cuts the Cone DCE, and alſo the Side DC produced to *z*, therefore the Parallels upon that Plane are Hyperbola's.

4. If a Plane cuts both Sides of the Cone under the Vertex, the Shadow of the Point C will deſcribe upon that Plane an Ellipſis.

DYE [in *Architecture*] is the Middle of the Pedeſtal, or that Part which lies between the Baſe and the Cornice; being ſo named, becauſe it is frequently made in the Form of a Cube or Dye, and is alſo called *Dado* by the *Italians*.

DYPTERON, or a *Dypterick* Figure or Order of Pillars in Architecture, is where the Temple, Edifice, &c. is environ'd round with a twofold Range of Pillars in the Form of a double Portico. This *Vitruvius* tells us, *Ch.* 1. *Book* 3. was the Figure of the wonderful Temple of *Diana* at *Epheſus*, which was above 200 Years in Building, all *Aſia* contributing to its Expence: Theſe Columns were all of Marble, and 70 Feet high.

DYSESTHESIA, is the Difficulty of, or Fault in Senſation. *Blanchard.*

DYSCRACY or *Intemperature*, is when ſome Humour or ill Quality over-abounds in the Body. *Blanchard.*

DYSENTERY, is a Looſeneſs accompanied with Gripings in the Belly, wherein bloody and purulent Excrements, and ſometimes membranous Pieces of the Inteſtines too are excerned; always, or very frequently, attended with a continual Fever and a Drought. *Blanchard.*

DYSEPULOTICA, are great Ulcers beyond Cure. *Blanchard.*

DYSOREXIA, a want of Appetite, proceeding from an ill Diſpoſition or diminiſhed Action of the Stomach. *Blanchard.*

DYSPATHY, is an impatient Temper, or a Languiſhing under ſome grievous Diſeaſe or Trouble of Mind. *Blanchard.*

DYSEPESIA, is a Difficulty of Digeſtion, or Fermentation in the Stomach and Guts. *Blanchard.*

DYSPHONIA, is a Difficulty of Speech from an ill Diſpoſition of the Organs. *Blanchard.*

DYSPONEA, is a Difficulty of Breathing, wherein the Breath is drawn often and thick, occaſioned by the Stuffing of the Lungs. *Blanchard.*

DYSTHERAPEUTA, are Diſeaſes of difficult Cure. *Blanchard.*

DYSTRIACHISIS, is a continual Defluxion of Tears from the pricking of Hairs in the Eyelids, which grow under the natural Hairs. *Blanchard.*

DYSTICHIA, is a double Row of Hair on the Eye-lids. *Blanchard.*

DYSTOCIA, is a Difficulty of bringing forth; or a preternatural Birth, as when the *Fœtus* comes forth obliquely, tranſverſe, or with its Feet foremoſt, or when the Paſſages are ſtraitned by Inflammation, or otherwiſe, or when the *Fœtus* is very large, weak, fat, or dead. *Blanchard.*

DYSTRICHIASIS, is when the Hairs grow inverſe. *Blanchard.*

DYSURIA, is a Difficulty of Urine, proceeding from an ill Diſpoſition of the Organs, or from an Obſtruction of them by the Stone, Gravel, or Viſcous Clammy Humours, accompanied with a Heat of the Urine. *Blanchard.*

EALDERMAN was a Title among the *Saxons*, of the ſame Import as *Earl* among the *Danes*, and ſignified an *Elder* or *Stateſman* ; ſuch a one as the *Romans* call'd *Senator:* And to this Day we uſe the Word *Alderman* in the ſame Senſe for an Aſſociate to the Chief Officer in the Common Council of any Town or City, and ſometimes for the Chief Officer himſelf.

EAR. This curious Inſtrument of Hearing, is divided into the *External* and *Internal Ear.*

The *External* is compoſed of a Cartilage covered with a Skin very delicate, under which you meet with another Nervous Tegument, that immediately embraces the whole Cartilage ; which, after ſome few Folds, terminates in that part of the Ear which is called the *Concha*, for its Reſemblance to the Entrance of a ſmall Shell: Beſides theſe, it hath two Muſcles ;

The Firſt is made up of certain Carneous Fibres, fixt to that part of the *Pericranium* that covers the Muſculous *Crotaphytes*, and deſcends in a ſtraight Line to inſert it ſelf at the upper part of the ſecond Folding of the Ear.

The Second likewiſe conſiſts of five or ſix Carneous Fibres, that take their Riſe from the upper and foremoſt part of the *Apophyſes Maſtoides*, and deſcending obliquely for about an Inch, terminate at the Middle of the *Concha.*

Arteries it hath from the *Carotides*, one Branch of which paſſeth behind, and the other before ; and the Diſtribution of theſe is attended by Veins from the *External Jugular.*

The Hole of the Ear, is a Tube reaching from the *Concha* to the *Tympanum*, and conſiſts partly of a Cartilage, and partly of a Bone, the Skin that covers it is furniſhed with an infinite Number of Glandules of a yellowiſh Colour, each of which hath its Tube opening into the Cavity of the Ear, and ſending forth that yellow glewy Subſtance, which is commonly found there: At the End of this Paſſage is ſeated the Membrane, called the *Tympanum*, or *Drum*, being almoſt round, dry, thin, and tranſparent, and is inchaſed in a Channel cut in the Bone at the End of the Tube.

After this Membrane ſucceeds a Cavity called the *Barrel*, from the likeneſs it has to the *Barrel* of a *Drum*, being on the Sides encompaſſed by the Bone, cloſed before by that Membrane, and behind by the Surface of the *Os Petroſum.* This *Barrel* contains in it two *Channels*, two *Apertures*, four *Bones*, three *Muſcles*, and one *Branch* of the *Nerve.*

The Channel that goes from the Ear to the Palate, is called the *Aqueduct.*

The Apertures, or Windows, are ſituated in the Superficies of the *Os Petroſum*, oppoſite to the *Tympanum* ; the higheſt is the Oval-Window, in the Bottom of which is a ſmall Edge whereon the Baſis of the *Incus* reſts ; the other, which is called the Round Window, has a ſmall Channel, in which is ſet a very fine, dry, and diaphanous Membrane, like that of the *Tympanum.*

The Firſt of the Bones is called *Malleus*, whoſe Length is about $\frac{4}{15}$ of an Inch, the Diameter of its Breadth is one Third of its Length.

The Second is the *Incus*, the longeſt of whoſe Legs is joined to the *Stapes* by the Mediation of the fourth Bone.

Of the three Muſcles which are contained in this Cavity, Two belong to the *Malleus*, the Third to the *Stapes.* Laſtly, The Branch of the Nerve which paſſes behind the *Tympanum*, has been taken by ſome for the Tendon of the Muſcle of the *Malleus*, and is a Branch of the fifth Pair.

The two Windows open into a Cavity, which is hewn in the *Os Petroſum*, called the *Labyrinth*, divided likewiſe into three Parts, *viz.* the *Entry of the Labyrinth*, the three *Semi-circular Canals*, and the *Concha.*

The Entry of the Labyrinth is ſituated behind the Oval Window, and hath Nine Apertures, *viz.* the Oval one, and the Right one, the firſt of which leads into the upper Part of the *Concha* ; five belong to the *Semi-circular Canals*, and the two laſt tranſmit two Branches of the ſofter Portions of the *Auditory Nerve*, &c.

The *External Ear* collects the Sounds, and augments the Impreſſion by the various Reflections the Voice undergoes in its Paſſage thro' the Folds of it.

The Uſe of the Muſcles is thought to contract or dilate the *Concha*, as the Tremblings of the Air are ſtrong or weak.

In the *Internal Ear* the *Tympanum* is ſtretched and made ſlack again by the Muſcles of the *Malleus* ; in the Tenſion of it both Muſcles act, but in the Relaxation, only the External, whoſe Action it is to reduce it from a Concave to a Plain, as is manifeſt from the Inſertion of the Muſcles ; the Determination of which Action proceeds from the various Diſpoſitions and Appulſe of the Objects, as a ſharp Note is cauſed by a Body, whoſe Parts are ſo diſpoſed, as to be capable of very quick Vibrations, which they as ſuddenly impreſs on the Air: On the contrary, the flat Note proceeds from the ſlower Strokes of a Body, with Parts that can only be ſo agitated ; to which Differences the *Tympanum* readily complies, and does, as it were, put on their particular Character ; this is delivered thence to the *Malleus*, and ſo forward, till at laſt the ſame Fluctuation is cauſed in the *Os Petroſum*, and in the *Labyrinth.*

The Aqueduct ſerves chiefly for the Ingreſs and Egreſs of Air to and from the Cavity, into which it opens.

From the Communication of the harder Portion of the *Auditory Nerve*, with the Branches of the Fifth Pair, which are diſtributed to the Organs of the Voice, proceeds that Sympathy between Speaking and Hearing. From the Communication of other Nerves follow the Motions of the Body, and even of the Spirits, which often accompany the Sounds we hear ; as in the Effects of *Muſick*, &c.

To this I ſhall add, Dr. *Keill's* Anatomy of the *Ear.*

The Ear is divided into the *External* and *Internal.* The *External* Ear (whoſe Parts have already been deſcrib'd) is compoſed of the Skin, a Cartilage, and a little Fat. The Skin of this Part is thin and ſmooth, it ſticks cloſe to the Cartilage by means of a fine Membrane. The Cartilage is in that Part of the *External* Ear call'd the *Pinna* ; and the Fat in that Part call'd the *Lobe.* The Veſſels of the *External* Ear, are Arteries from the *Carotidal* Veins, which go to the *Jugulares*, and the Nerves from the *Portio Dura*, and ſecond Pair of the Neck.

The *External* Ear is tied to the *Os Petroſum* by a ſtrong Ligament, which comes from the Backſide of the *Pinna.* Though the Ear has but a very obſcure Motion, yet it hath two Muſcles: The firſt ariſes from the Outſide of the Frontal Muſcle, where it joins the *Crotaphite*, and is inſerted into the Upper and Back Part of the *Pinna.* The ſecond ariſes from the Upper and Foremoſt Part of the *Proceſſus Mamillaris*, and is inſerted into the Middle and Back Part of the *Concha.* The firſt ſhould draw the Ear upwards, and the ſecond downwards and backwards; but the continual binding of our Ears when young, deprives us of their Uſe. The Uſe of the *External* Ear is to gather the Sounds, and to carry them to the *Internal.* Its Inequalities and Circles do moderate the Violence of the Air.

The *Internal* Ear begins at the Conduit which goes from the Middle of the *Concha* to the *Tympanum:* it is call'd *Meatus Auditorius.* It is cartilaginous from the *Concha* till within a little of the *Tympanum*, where it is bony; yet this Cartilage goes not compleatly round, for towards the Temple its Edges do not meet by above a Line. The Paſſage is crooked, running firſt upwards and then downwards to the *Tympanum.* It is covered within by a pretty thick Membrane. Betwixt this Membrane and the Cartilage, eſpecially where it is ſlit, there are a great Number of little Glands, whoſe Execretory Channels piercing this Membrane, carry a yellow ſort of Excrement into the *Meatus*, which hinders Inſects or any other thing to enter the Ear.

At the further Extremity of this Conduit, there is a thin tranſparent Membrane ſtretch'd out like the Head of a Drum, upon a bony Circle, which wants about half a Line of being compleat. The Handle of the *Malleolus* is tied to this Membrane, which it draws ſomewhat inwards, making it a a little Concave towards the *Meatus Auditorius:* And there runs a ſmall Twig of a Nerve from the fifth Pair upon its Inſide, call'd *Chorda Tympani*; for the Membrane it ſelf is called *Tympanum.*

Behind this Membrane there is a pretty large Cavity, called the *Barrel*; it is about three or four Lines deep, and five or ſix wide. It is lined with a fine Membrane, on which there are ſeveral Veins and Arteries. It is always full of a purulent Matter in Children. In this Cavity there are four ſmall Bones, of which,

The firſt is the *Malleolus*, or Hammer, ſo called becauſe of its Shape. Its Head hath on its lower Side two Protuberances, and a Cavity whereby its joyned to the *Incus* by *Ginglymus:* Its Handle, which is pretty long and ſmall, is faſtened to the *Tympanum.* Near its Head it has two ſmall Proceſſes, and it is moved by three Muſcles.

The Firſt is called the *Externus*; it ariſes from the upper and external Side of the *Meatus Auditorius*, and is inſerted into the upper and longer Proceſs of the *Malleolus*, which it draws outwards. This is neceſſary when Sounds are too great, which might break the *Tympanum.*

The Second is the *Obliquus*; it lies in the external Part of the Conduit which goes to the Palate, and entring the Barrel, it is contained in a Sinuoſity of the Bone by the upper Edge of the *Tympanum*, and is inſerted into the ſlender Proceſs of the Hammer, aſſiſting the former Muſcle in its Action.

The Third is the *Internus*, which ariſes from the Extremity of the bony Part of the Conduit which leads to the *Fauces*, and lies in a *Sinus* of the *Os Petroſum*, till it paſſes over a little Riſing of the Bone at the *Feneſtra Ovalis*, to be inſerted into the poſterior Part of the Handle of the *Malleolus.* This Muſcle, by pulling the Hammer inwards, diſtends the *Tympanum.*

The Second ſmall Bone is call'd *Incus*, the Anvil: It has a Head, and two Legs. Its Head has a Protuberance, and two Cavities, whereby it is articulated with the Hammer; the ſhorter of its Legs is tied to the Side of that Conduit which goes to the *Proceſſus Mamillaris*, and its longer Leg to the Head of the Third Bone, called,

The *Stapes*, or Stirrop, becauſe of its Reſemblance. 'Tis of a Triangular Figure, being made of two Branches ſet upon a flat Baſis, which ſtands upon the *Foramen Ovale.* The Space between the two Branches is fill'd up by a fine tranſparent Membrane; the Union of the two Branches is called the Head of the Stirrop, in which there is a ſmall Cavity, in which lies the Fourth Bone. There is a ſmall Muſcle which ariſes out of a ſmall Canal in the bottom of the Barrel, and which is inſerted into the Head of the Stirrop.

The *Os Orbiculare*, which is a very ſmall Bone, being Convex on that Side which is received in the Cavity of the Head of the Stirrop, and hollow on the other Side, where it receives the long Leg of the Anvil, which is only joyned to the Stirrop by means of this Fourth Bone.

Beſides theſe Bones, there are ſeveral Holes in the Barrel. The Firſt is in its Fore-part neareſt the *Tympanum.* It is the Entry to the *Sinus* in the Mammillary Proceſs. The Second is the Orifice of a Conduit, which opens behind the Palate of the Mouth. The Beginning of this Conduit is bony; and its Extremity, which is near the *Uvula*, is membranous. Part of the Air which we breathe, enters by this Conduit into the Ear. The Third and Fourth are in the Internal Proceſs of the *Os Petroſum.* The one is called *Feneſtra Ovalis*; the Baſis of the Stirrop ſtands upon it; it is the Entry to the *Veſtibulum.* The other is called *Feneſtra Rotunda*; it is covered by a fine Membrane, inchaſed in a Rift of this Hole; it leads to the *Cochlea.*

The *Veſtibulum* is a Cavity in the *Os Petroſum*, behind the *Feneſtra Ovalis*; it is covered with a fine Membrane: In it open the Semi-circular Pipes of the Labyrinth. The upper Turning of the *Cochlea*, and the Auditory Nerve, pierces into it alſo.

The *Labyrinth* is made of three Semi-circular Pipes excavated in the *Os Petroſum*; they open by five Orifices into the *Veſtibulum.* That which is called the Superior Pipe, joins one of its Extremities with one of the Extremities of that which is call'd the Inferior Pipe; and theſe two Extremities open by one Orifice, but the middle Pipe opens at each End by it ſelf into the *Veſtibulum.*

The laſt Cavity of the Ear is the *Cochlea*; it reſembles a Snail's Shell. Its Canal, which winds in a Spiral Line, is divided in two, the Upper and Lower, by a thin *Lamina Spiralis.* The Edge of this *Lamina* is membranous, where there are ſeveral Holes, through which Twigs of the Auditory Nerve paſs from the one Canal to the other. The Upper Canal opens into the *Veſtibulum*, and the Lower into the *Barrel*, by the *Feneſtra Rotunda.*

The Veſſels of the *Internal* Ear are Arteries and Veins from the Internal *Carotides* and *Jugulars*. The *Nervus Auditorius* enters by the Hole in the Internal Proceſs of the *Os Petroſum*. It conſiſts of two Bundles, of which one is hard, the other ſoft. Its *Portio Mollis* is diſtributed through all the *Cochlea* and *Labyrinth*; and the *Portio Dura* is beſtowed on the External Parts about the Ear.

Sounds being gather'd by the External Ear, paſs through the *Meatus Auditorius*, and beat upon the *Tympanum*, which moves the four little Bones in the Barrel. In like manner as it is beat by the External Air, theſe little Bones move the Internal Air which is in the Barrel and *Veſtibulum*: which Internal Air makes an Impreſſion upon the Auditory Nerve in the *Labyrinth* and *Cochlea*, acordingly as it is moved by the little Bones in the Barrel. So that, according to the various Refractions of the External Air, the Internal Air makes various Impreſſions upon the Auditory Nerve, the immediate Organ of Hearing: Theſe different Impreſſions repreſent different Sounds.

See *Maria Valtalva de Aure Humana Tractatus*.

EARING, aboard a Ship, is that Part of the Bolt-Rope (or Rope wherein the Sail is ſewed) which at the four Corners of the Sail is left open in the Form of a Ring: The two uppermoſt of which four Earings are put over the Yard-Arms to faſten the Sail to the Yard; and into the lower Earings the Tacks and Sheets are ſeized, or, as they call it, are there *bent unto the Clew*.

EARL, anciently was the Title given to ſuch as were Aſſociates to the King in his Councils or Martial Expeditions; as *Comes* was to thoſe who followed the Magiſtrates of *Rome*, as their Deputies to execute their Offices for them; and this Title died always with the Man. The old Way of making Earls was only *Cincturam Gladii Comitatus*, without any formal Method of Creation. But *William* the Conqueror, ſaith *Cambden*, gave this Dignity in Fee to his Nobles, annexing it to this or that County, and allotting them a Proportion of Money, ariſing from the Prince's Profits, for the Pleadings and Forfeitures of the Province. Now, and long ſince, Earls are made by the Kings of *England*, by their Charters; but without any Authority over any County, and without any Profit ariſing from thence, but ſome annual Stipend out of the Exchequer for Honour's Sake. The Solemnity of their Creation you may find at large in *Stow*'s Annals. Their Place is next after a Marquis, and before a Viſcount.

EARTH. The Surface of the whole Earth, Mr. *Keil*, in his Examination of Dr. *Burnet*'s *Theory*, makes to be 170981012 *Italian* Miles, and the *Italian* Mile is little leſs than the *Engliſh* one.

The Ambit of the Earth (or the Circumference of a Great Circle of it) according to the *French* Meaſures, is 123249600 *Paris* Feet, or $24649\frac{46}{50}$ *Engliſh* Miles.

The Mean Semi-diameter of the Earth is 196158000 *Paris* Feet, or 3933 Miles (of 5000 Feet to a Mile;) But the Earth is higher at the Equator than at the Poles by 82500 Feet or 17 Miles.

So that the Radius of the Earth may be taken in a round Number as 200000000 Feet.

The Solid Content of the Globe of the whole Earth is 30000 000000 000000 000000 Cubick Feet.

According to Mr. *Caſſini*, the Earth's greateſt Diſtance from the Sun is 22374, mean Diſtance 22000, and leaſt Diſtance 8022 Semi-diameters of the Earth.

On Suppoſition that the Sun's Parallax be 32 Seconds, which is a Mean between 40 Seconds and 24 Seconds, the Earth's mean Diſtance from the Sun will be 54000000 of Miles. Mr. *Whiſton*.

Sir *Iſ. Newton* takes the Earth's Diameter, ſeen from the Sun, to be 24 Seconds, and conſequently the Sun's Parallax to be 12 Seconds; which agrees with our Accurate Aſtronomer Mr. *Flamſtead*, and *Horrox*'s Obſervations; and then the Diſtance from the Earth to the Sun will be much greater.

The Figure of our Earth is moſt probably that of an *Oblate Spheroid*, ſwelling out towards the Equatorial Parts, and flatted or contracted towards the Poles; ſo that the Diameter of it at the Equator, is longer than the Axis by about 34 Miles, according to Sir *Iſ. Newton*; for the Polar Diameter or Axis: is to the Equatorial one :: As 689 : to 692.

If the Earth were ever in a Fluid State, its Revolution round its Axis muſt neceſſarily make it put on ſuch a Figure; becauſe near the Equatorial Parts muſt needs be the greateſt Centrifugal Force, and conſequently there the Fluid would riſe and ſwell moſt.

And that it ſhould be ſo now, ſeems neceſſary to keep the Sea in the Equinoctial Regions from overflowing the Earth thereabouts.

Experiments alſo made on Pendulums, which require different Lengths to ſwing Seconds here, and at the Equator, prove the ſame thing.

And if what Mr. *Caſſini* ſays, in *Philoſophical Tranſactions*, *Numb.* 278. is certain from Experience, *viz.* that the Degrees of one, and the ſame Meridian on the Earth, increaſe about $\frac{1}{800}$ Part as you go Southward, or are longer towards the Equator in any Proportion, then the Earth muſt needs be of ſuch a Figure, as indeed is that of *Jupiter*, as appears from Obſervation.

The Learned Dr. *Gregory*, in his *Aſtronomia Geometrica & Phyſica*, *Prop.* 52. *Lib.* 3. ſhews a Method to determine the Figure of the Earth exactly, and to find the Ratio of the Axis of it to its Equatorial Diameter: And demonſtrates, That the Earth muſt be of the Figure now mentioned, *viz.* an *Oblate Spheroid*.

He ſhews alſo, That the Prolate Spheroidical Figure of the Earth, is the Reaſon both of the Receſſion of the Equinoctial Points; and alſo, That the Earth's Axis doth twice every Year change its Inclination to the Ecliptick, and as often return back again to its former Poſition. *Aſtron. Pag.* 77. *Lib.* 1. *Prop.* 64.

The Earth's mean Revolution, in reſpect of the fix'd Stars, is 23 Hours, 56 Minutes.

Captain *Halley*, in his Obſervation of *Mercury* in the Sun at St. *Helena*, 1677, tells us, That the Annual Motion of the Earth is ſo exceeding ſwift, as far to exceed that of a Bullet ſhot out of a Cannon, and to be after the Rate of 3 *Engliſh* Miles and an half in a Second, which is 210 Miles in a Minute, and 12600 Miles in an Hour.

The Axis of the Earth is inclined to that of the Ecliptick, in an Angle of 66 Degrees 30 Minutes.

And tho' in one Annual Revolution, its Axis appears to keep exactly parallel to it ſelf; yet in many Years this Poſition becomes ſenſibly changed. *Greg. Aſtron.*

The Earth doth not deſcribe an Orbit round the Sun properly by her own Center, but by the *Common Center of Gravity of the Earth and the Moon*.

And this is the Reaſon of the Inequality of the Earth's Motion. *Greg. Aſtron.*

The Earth's Horizontal Parallax to an Eye at the Sun's Surface, will be ſixteen Minutes, the half of the Sun's apparent Diameter.

Our moſt Accurate Aſtronomer Mr. *Flamſtead*, found the Diſtance of the Pole-Star from the Pole, to be greater about the Summer Solſtice than at the Winter, by about 40 or 45 Seconds; and this he ſaith, he confirmed by repeated Obſervations, made for above ſeven Years ſucceſſively, as he acquaints Dr. *Wallis* in a a *Latin* Letter to him in the Year 1698, which Letter is publiſhed in the Third Volume of Dr. *Wallis*'s *Latin* Works: And ſince that he hath told me, That he finds a ſenſible Annual Parallax in others of the fixed Stars, as well as that; and from thence he concludes (I think very juſtly) that the Earth muſt move annually round the Sun.

As to the Reaſon of the Paralleliſm of the Earth's Axis in all Parts of its Annual Orbit, ſee the Word *Parallelíſm.*

That the Earth is nearer to the Sun in *December*, than it is in *June*; and conſequently, that its Perihelion is in the Month of *December*, is plain,

Firſt, Becauſe the Sun's apparent Diameter is then greater than at *Midſummer.*

And alſo, Becauſe the Earth moves much ſwifter then, by one 25th Part, than at *Midſummer.*

And from hence it is, that there are about eight Days more in the Summer Half-Year, from *March* to *September*, than in the Winter, from *September* to *March.*

Mr. *Whiſton*, in his *Lemmata*, proves very eaſily, That the Annual Motion belongs to the Earth about the Sun, not to the Sun about the Earth.

For when from the *Moon's Orbit*, and the *Planet's Orbits*, and *Periodical Times*, 'tis certain, That the Law of Gravitation towards the Earth and towards the Sun is the ſame; and by conſequence, all the *Periodical Times* of *Bodies* revolving about each of them, are in the ſame Proportion to one another, compared with their ſeveral Diſtances from each of them; on which *Hypotheſis* this Proportion ſuits the *Phænomena* of Nature: the ſame muſt be the true one, and to be fully acquieſc'd in.

Now 'tis known, That on the *Hypotheſis* of the *Earth*'s Annual Motion, her *Periodical Time* exactly ſuits, and is ſo between that of *Mars* and *Venus*, as the Proportion obſerved through the whole *Syſtem*; but on the other *Hypotheſis* 'tis enormouſly different: For when the Moon undoubtedly, and on this *Hypotheſis*, the Sun alſo revolves about our Earth; and when the Diſtance of the Sun is to that of the Moon, as about 10000 to 46: and the *Moon*'s Periodical Time leſs than 28 Days; the Periodical Time of the Sun is by the *Rule of Three* diſcoverable thus:

As the Cube of the *Moon*'s Diſtance, 46 equal to 97336: (to the Cube of the *Sun*'s Diſtance 10000 equal to 1000000000000, or almoſt as 1 to 10000000) :: ſo muſt the Square of the *Moon*'s Periodical Time, 28 Days equal to 784: be to the Square of the *Sun*'s Periodical Time, 7840000000, whoſe Square Root 88204, are Days alſo, equal to 242 Years.

So that on the *Hypotheſis* of the *Sun*'s Revolution about the Earth, its Perodical Time muſt undoubtedly be 242 Years, which all Experience atteſts to be but a ſingle one: So that the Controverſy between the *Ptolemaick* and *Pythagorean Syſtems* of the World, is to a Demonſtration determined, and the *Earth*'s Annual Motion for ever unqueſtionably eſtabliſhed.

N. B. This Computation is upon a Suppoſition, that the Sun's Horizontal Parallax is 32 Seconds, which Mr. *Whiſton* takes as a middle Rate: But if you ſuppoſe it to be but 10 Seconds, which agrees much better with the Obſervations of our greateſt Aſtronomers, Mr. *Flamſtead* and Mr. *Caſſini*, who both make the Sun to be diſtant from us 11000 Semi-diameters of our Earth; then the Sun's Motion thro' the *Magnus Orbis*, will be found not to be performed in leſs than 597,3 Years, as any one may eaſily find by Calculation, as above.

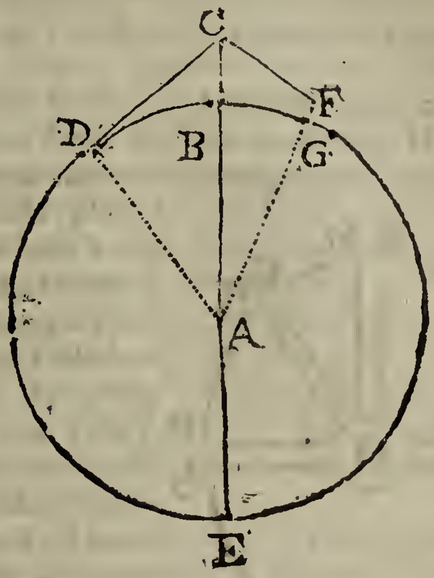
He tells us alſo, *Lemma* 56. That if our Earth once revolved about the Sun in a Circular Orbit, whoſe Semi-diameter were equal to the Earth's Original Diſtance from the Sun, 6 Degrees paſt its Perihelion, the Annual Period was exactly equal to 12 Synodical or 13 Periodical Months. 'Tis evident, that 12 Synodical, or 13 Periodical Months, (equal to each other in this Caſe) are 355 Days, 4 Hours, 19 Minutes. 'Tis alſo evident, that the Eccentricity of the Earth's Orbit, or the Diſtance between the *Focus* and Center of its *Ellipſis*, was, according to the ancient Aſtronomers, *Hipparchus* and *Ptolemy*, $\frac{21}{1000}$ of the entire middle Diſtance. By the Moderns 'tis found ſomewhat leſs, (and thoſe who know Sir *Iſ. Newton*'s Philoſophy, will eaſily allow of ſome Diverſity in different Ages) by *Tycho* 'twas determined to be near $\frac{18}{1000}$; by *Caſſini* ſince $\frac{17}{1000}$; and laſt of all, by our moſt accurate Obſerver Mr. *Flamſtead* $\frac{1692}{100000}$ or near $\frac{17}{1000}$, as *Caſſini* had before determined.

All which conſidered, we may very juſtly take the Middle between the Ancient and Modern Eccentricity, $\frac{19}{1000}$, for the true Original one, and about $\frac{185}{100000}$, or more nicely $\frac{1846}{100000}$, for the Difference between the Ancient Semi-diameter of the Circular Orbit and the middle Diſtance in the preſent Eccliptick one; the Point of Acceleration being about 6 Degrees paſt the *Perihelion*, not juſt at it.

Then, by the *Golden Rule*, As the Cube of 100000 (the middle Diſtance in the *Ellipſis*): to the Cube of 98154, (the Semi-diameter of the Ancient Circle) :: ſo is the Square of 525949, (the Number of Minutes in our preſent Solar Year): to the Square of the Number of Minutes in the ancient Solar Year, whoſe Root being 511459 Minutes, or 355 Days, 4 Hours, 19 Minutes, appears to be exactly and ſurprizingly equal to the Lunar Year beforementioned.

Upon this *Hypotheſis* the ancient Solar and Lunar Year were exactly commenſurate and equal; and 11 Days, 1 Hour, 30 Minutes, ſhorter than the preſent Solar Year.

EARTH. There have been ſeveral Methods thought of to find the Magnitude of the Earth: As, 1. *To find its Diameter, by having the Height of ſome very eminent Mountain, and the Length of a Viſual Ray, that ſhall be a Tangent to the Earth's Surface at ſome conſiderable Diſtance from the Top of the Hill:* For the Square of ſuch a Tangent being (by 35 *E.* 3.) equal to the Rectangle, under the whole Line made by the Earth's Diameter, and the Height of the Mountain together, if you divide *DCA* by *CB*, i. e.



the Square of the Diſtance, from the Top of the Hill to the Earth's Surface, by the Hill's Height, the Quotient will be the Line *C. E*, *(viz.)* the Aggregate of the Earth's Diameter and the Mountain's Height; the latter of which being given, the former is ſo.

2. Let a Spectator on the Top of a high Hill, as at *C*, with an Inſtrument, take the Angle *DCB*; which may beſt be done by the Help of the Sun or Moon's being in the Horizon; for that Way the Horizon will be the moſt accurately determin'd. Then the Length of the Tangent *CD*, being ſome-how known, in the Right angled △ *DCA*, the Line *DA* = to the Earth's Semi-diameter may eaſily be drawn, and its Length found by Calculation.

3. The Angle *DCA* being taken, and the Mountain's Height *CB* known; the Earth's Radius *BA* may be had without knowing the Diſtance *CD*: For in the △ *DCA* all the Angles are known, and the Length *BC* is only the Exceſs of the Secant *CA* above the Radius *BA* or *AD*; wherefore by the Tables of Sines, Tangents, and Secants, the Radius *AD* will be known.

There is alſo another way a-kin to theſe, of finding a Part of the Circumference of a great Circle on the Earth, by having the Altitude of two high Mountains, and their Diſtance from each other. But none of theſe Ways can be depended upon, tho' they are built upon Geometrical Principles, and are great Iuſtances of the due Thought and Penetration of the Inventers; becauſe there will be ſo many unavoidable Difficulties in the different Refraction of the Atmoſphere, in taking the exact Height of the Mountains, or the Diſtance of their Tops from the Earth's Surface in *D*, that there can nothing certain be determin'd from hence.

The beſt Method therefore to gain this Point, is that which Mr. *Norwood* here in *England*, and Mr. *Picart* in *France*, proceeded in; which was to meaſure the Diſtance, in Miles, or rather in Yards or Feet, between two Places ſituate under the ſame Meridian, and at leaſt a Degree one from another; that ſo the Number of Miles contain'd in one Degree of a great Circle of the Earth, being exactly known, the Earth's Circumference will be eaſily had, by only multiplying thoſe Miles by 360. And this the *French* Mathematicians ſeem to have done ſo nicely, that hardly any thing more exact can be expected. They make the Ambit of the Earth to be 123249600 *Paris* Feet; that is, nearly 131630573 *Engliſh* Feet, or 24930 of our Statute Miles. Whence the Diameter muſt be 41899310 *Engliſh* Feet, and nearly 7935 Statute Miles.

Of the Figure of the EARTH.

Dr. *John Keil*, in a Book that he wrote againſt Dr. *Burnet's Theory* of the Earth, has ſhewn, how the Figure of the Earth is deduc'd from the Laws of Gravity and centrifugal Force.

It is true he has made a Miſtake concerning the Meaſure of the Degrees of an Ellipſe; but all that he relates as to the Oblate Spheroidical Figure of the Earth is right; and the ſmall difference of taking 15 *Paris* Feet for the Space that a Body falls through in a Second of Time, inſtead of 15 Feet 1 Inch and 2 Lines, and a number of Feet a little leſs than true for the Diameter of the Earth (which was not ſo well known in the Year 1698, when he wrote) will not at all invalidate his Demonſtration and Proof, which is as follows.

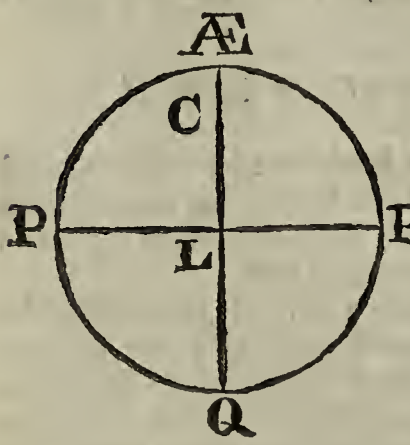
To prove that the Earth is higher at the Equator than at the Poles, he ſuppoſes firſt, that at the Beginning of the World, the Earth was fluid and ſpherical; but that Almighty God having afterwards given it a Motion round its own Axis, all Bodies upon the Earth would deſcribe, either the Equator or Circles parallel to the Equator, and by conſequence, all would endeavour to recede from the Center of their Motion.

Here it is to be obſerv'd, that if a Body does freely revolve in a Circle about the Center, as the Planets do about the Sun, that its centripetal Force (or that Force by which it is drawn towards the Center) is always equal to its Force by which it endeavours to recede from the Center; for the Force which detains a Body in its Orbit, muſt be equal to the Force by which it endeavours to recede from its Orbit, and to fly off in a Tangent.

This may be clear by the Example of a Body turned round a Center by the help of a Thread, which detains a Body in its Orbit; the Thread being ſtretch'd by the Motion of the Body, will endeavour to contract it ſelf equally towards both Ends, by which it will pull the Center as much towards the Body, as it doth the Body towards the Center.

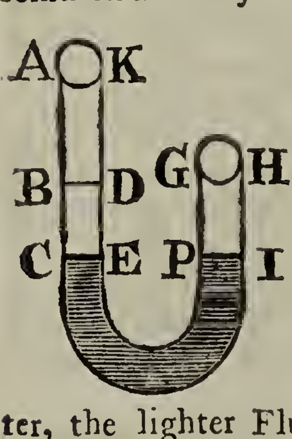
Now this centrifugal Force is always proportional to the Periphery, which each Body deſcribes in its diurnal Motion, by the firſt *Theorem* of *Hugenius de vi centrifuga*: So that under the Equator, which is the largeſt Circle, the centrifugal Force would be the greateſt, and ſtill grow leſs as we approach the Pole, where it quite vaniſheth, there being no diurnal Motion there. And without doubt, all Bodies having this centrifugal Force, by which they endeavour to recede from the Center of their Motion, would fly off from the Earth, if they were not kept in their Orbit by their Gravity, or that Force by which they are preſs'd towards the Center of the Earth, which is much ſtronger upon our Earth, than the centrifugal Force; and becauſe the Gravity upon the Surface of the Earth is always the ſame; but the centrifugal Force alters and grows leſs, the nearer we come to the Poles; it is plain, that the Gravity under the Equator, having a greater Force to oppoſe it, than that which is near the Poles, will not act ſo ſtrongly in the one Place as in the other; and conſequently, Bodies will not be ſo heavy under the Æquator as at the Poles. ——

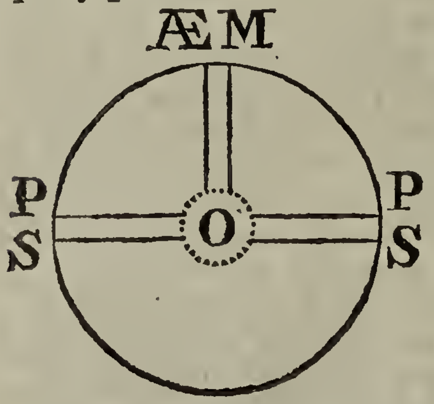
If the Circle *Æ P Q P* repreſent the Earth, *Æ Q* the Æquator, and *P P* the Poles; if *C* be a Body in the Æquator, it is evident, that it will be pull'd by two contrary forces; namely, that of its Gravity, which pulls it towards the center, and that of its centrifugal force which pulls it from it.



Now if both theſe forces were equal, it is evident, it would go neither of theſe ways, but if one were ſtronger than the other, it would move where the ſtrongeſt Force pulls it; but only with a Velocity which is proportional to the differences of theſe two Forces, and therefore it would not deſcend ſo faſt, as if there were no centrifugal Force pulling againſt it; that is, a Body in the Equator does not preſs leſs toward the Center than at the Pole, where there is no centrifugal Force to leſſen its Gravity: Therefore Bodies of the ſame Denſity, are not ſo heavy in one Place as in another.

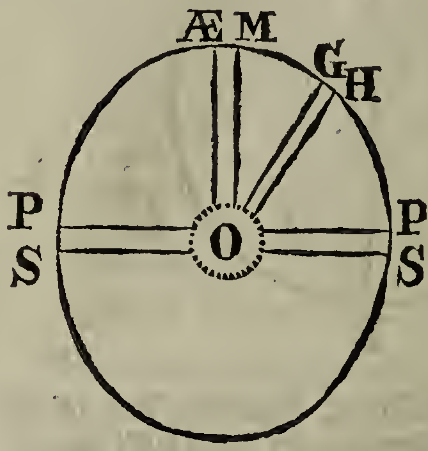
Now, in a ſpherical Fluid, all whoſe Parts gravitate towards the Center, I think it is evident, from the Principles of Hydroſtaticks and Fluidity, that all thoſe Bodies which are equally diſtant from the Center, muſt be equally preſs'd by the Weight of the incumbent Fluid; and if one Part come to be more preſs'd than another, that which is moſt preſs'd will thruſt that which is leaſt out of its Place, till all the Parts come to an Æquilibrium one with another: And this is known by a common and eaſy Experiment. If you take a recurved Tube and fill it with Water, or any other Fluid, it will riſe equally in both Legs of the Tube, ſo that the Surfaces C E and P I are equally preſs'd by the incumbent Columns B C E D and G P I H. But if one of the Legs of this Tube ſhould be fill'd with Oil, or ſome other lighter Fluid, and the other with Water, the lighter Fluid will riſe higher than the other; for otherwiſe theſe Surfaces, which are equally diſtant from the Center, would not be equally preſs'd.





Juſt ſo if P Æ M P S repreſents a fluid Sphere which may be imagin'd to be compos'd of a great many communicating Canals or Tubes, the fluid of every one of which preſſes upon the Center; now if the Fluid in every one of theſe Tubes was of equal Weight or Gravity, it is plain, that by that means they would alſo be of an equal height from the Center; for by that means only would the Center be equally preſs'd by the weight of all the Tubes: But if the Fluid in the Canal Æ O M were lighter than the Fluid in the Canal P O S, it is plain that in this caſe, the Fluid P O S preſſing more on the Center than the Fluid in the Canal Æ O M, the ſurface of the Fluid Æ O M will riſe to a greater height or diſtance from the Center; ſo that by its greater height, which recompences its leſſer Gravitation, it will preſs equally upon the Center with the Fluid in the Canal P O S.

After the ſame manner, if the Fluid in the Canal G O H were heavier than the Fluid in the Canal Æ O M, but lighter than that which is in P O S, then would the Canal G O H be ſhorter than ÆOM, but longer than POS, and the Figure compos'd of all theſe Tubes would be in the form of a Spheroid, which is generated by the circumrotation of a Semi-ellipſis about the Axis; but, as it has been already ſhewn, that if Æ O M repreſent the Semi-diameter of the Equator, that all Bodies in it are lighter than in P O S, the Axis of the Equator, (we take the Diameter and Axis here, not as pure mathematical Lines, but as ſmall Canals or Tubes.) And juſt ſo thoſe Bodies that are in the Tube G O H, has been prov'd to be lighter than thoſe in P O S, but heavier than the Bodies in Æ O M, the centrifugal force in G H being leſs than that which is in Æ M. And there is no centrifugal force in the Poles P S. It is plain therefore that the Tube Æ O M will be longer than G O H, and G O H will be longer than P O S; that is, the diameter of the Equator will be longer than the axis of the Earth, and conſequently the Figure of the Earth will be in the form of a broad Spheroid, which is generated by the rotation of a Semi-ellipſis round its leſſer axis. This may be ſufficient to convince the Theoriſt of the falſeneſs of his Aſſertion, ſince it is a plain demonſtration, that an Earth form'd from a Chaos, muſt have a very different Figure from what he ſuppoſes it had.

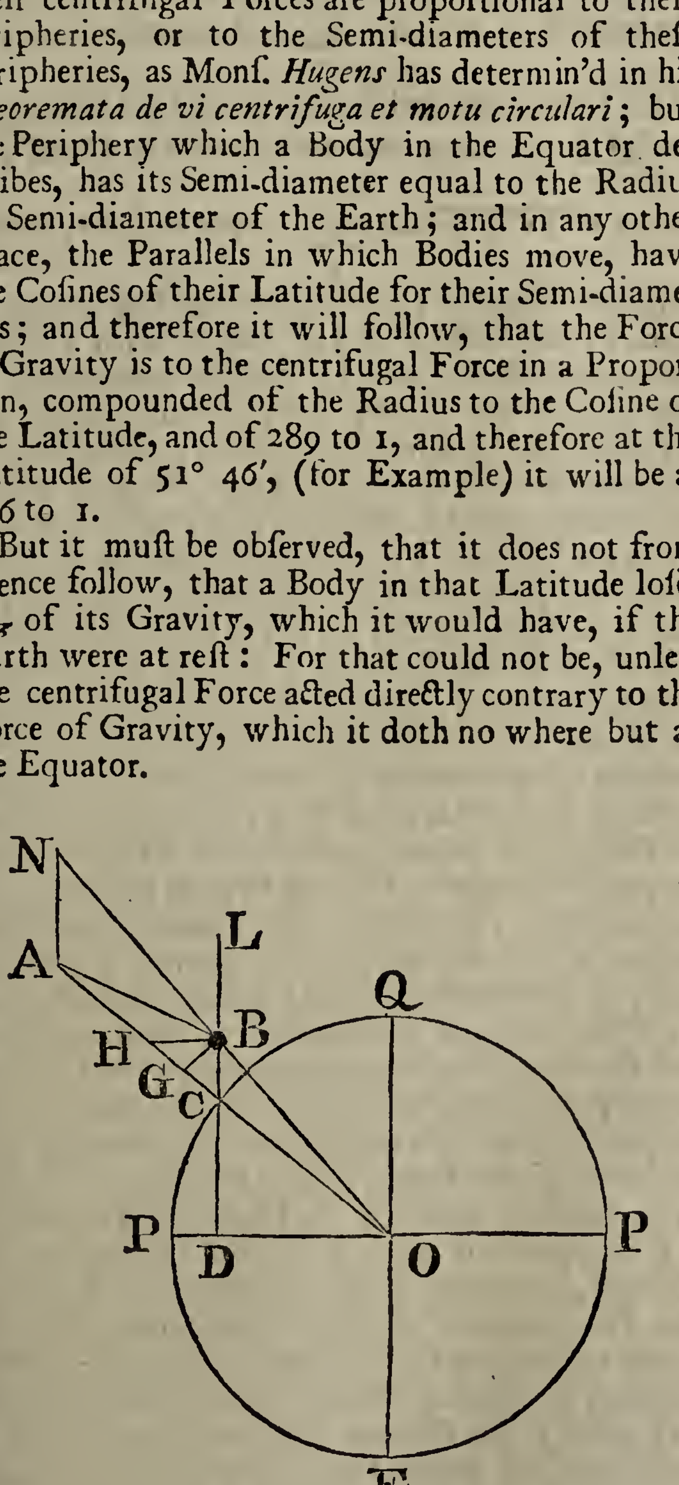


But to proceed farther, and inquire how much the Gravity is diminiſhed at the Equator, or any other Parallel, by the centrifugal Force, which all Bodies acquire by being turned round the Axis of the Earth, that from thence we may endeavour to determine, what proportion the Diameter of the Earth's Equator has to its Axis; in order to calculate which, we will firſt ſuppoſe, that the mean Diameter of the Earth is 19615800 *Paris* Feet, according to the late Obſervation of the *French* Mathematicians, and ſince the Earth turns round its Axis in the ſpace of 23 Hours 56′, for in that Time the ſame Meridian returns to the ſame immoveable Point of the Heaven again; (but the Sun in the mean time ſeeming to be mov'd a Degree according to the Series of the Signs, is the Cauſe why there are four Minutes more required before the Meridian can overtake him) from thence it follows, that a Body under the Equator moves through 1426,88 Feet in the ſpace of one Second of Time.

Now, according to the *Theorem* that Sir *Iſaac Newton* gives us, in his *Philoſophia naturalis Principia Mathematica*, *Schol. Prop.* 4. *Lib.* 1. the centrifugal Force of any Body has the ſame proportion to the Force of Gravity, that the Square of the Arch, which a Body deſcribes in a given Time, divided by its Diameter, has to the Space through which a heavy Body moves, in falling from a Place, in which it was at reſt in the ſame Time: and ſuppoſing a heavy Body to fall 15 Foot in a Second of Time; by Calculation, it will from thence follow, that the Force of Gravity has the ſame proportion to the centrifugal Force at the Equator, that 289 has to Unity; and therefore, by this centrifugal Force, which ariſes from the diurnal Rotation of the Earth round its Axis, any Body placed in the Equator, loſes $\frac{1}{289}$ Part of its Gravity, which it would have, if the Earth were at reſt; or which is the ſame thing, a heavy Body placed at either of the Poles, (where there is no diurnal Rotation, and conſequently no centrifugal Force) which weighs 289 Pounds, if it were brought to the Equator, would weigh no more than 288 Pounds.

Having thus determined the Proportion of the centrifugal Force at the Equator, to the Force of Gravity, it will be eaſy from thence, to ſhew their Proportions in any Parallel; for it is compounded of the Proportion of 1 to 289, and of the Coſine of the Latitude to the Radius; for if two Bodies deſcribe different Peripheries in the ſame Time, their centrifugal Forces are proportional to their Peripheries, or to the Semi-diameters of theſe Peripheries, as Monſ. *Hugens* has determin'd in his *Theoremata de vi centrifuga et motu circulari*; but the Periphery which a Body in the Equator deſcribes, has its Semi-diameter equal to the Radius or Semi-diameter of the Earth; and in any other Place, the Parallels in which Bodies move, have the Coſines of their Latitude for their Semi-diameters; and therefore it will follow, that the Force of Gravity is to the centrifugal Force in a Proportion, compounded of the Radius to the Coſine of the Latitude, and of 289 to 1, and therefore at the Latitude of 51° 46′, (for Example) it will be as 466 to 1.

But it muſt be obſerved, that it does not from thence follow, that a Body in that Latitude loſes $\frac{1}{466}$ of its Gravity, which it would have, if the Earth were at reſt: For that could not be, unleſs the centrifugal Force acted directly contrary to the Force of Gravity, which it doth no where but at the Equator.



For let the Circle Q P E P repreſent the Earth Q E, the diameter of the Equator, O its center, and let B repreſent a Body, which is ſuppos'd to hang by the thread A B, and to be placed any where between the Pole P and the Equator Q and let B D be drawn perpendicular to the Axis. it is plain that if the Earth had no diurnal Rotation, the Body B would draw the thread A B into the poſition of A C; ſince by that means it deſcends as near as it can to the center, and there it would ſtretch the thread with all the force of its gravity; or if we will ſuppoſe that the centrifugal force acted according to the ſame direction A C, it would then directly oppoſe the force of Gravity, and the thread would remain in the ſame poſition, but it would be ſtretch'd with a force proportional to the differences of thoſe two Forces.

But becauſe the Body B turns round the Center D, it will endeavour to recede from it according to the Line $C\ B$, in which Direction the centrifugal Force acting, it will not directly oppoſe the Force of Gravity, but it will draw the Thread from the Poſition $A\ C$, into the Poſition $A\ B$: Let $B\ G$ be drawn perpendicular to $A\ C$; if $B\ C$ repreſent the centrifugal Force, acting according to the Direction $B\ C$, it is equivalent (as is commonly known) to two Forces, one of which is as $C\ G$, and acts according to the Direction $C\ G$, which is contrary to that by which it deſcends to O; the other is as $G\ B$, and acts according to the Direction $G\ B$, which is no way contrary to the Force of Gravity. If therefore $B\ C$ repreſent the total centrifugal Force of the Body B, that Part of it, which directly oppoſes the Force of Gravity, will be $G\ C$; from whence it follows, that the Decreaſe of Gravity in going from the Pole to the Equator, is always as the Square of the Coſine of the Latitude: For draw $B\ H$ parallel to the Axis $P\ P$, and becauſe the Triangles $H\ C\ B$, $C\ D\ O$, are Equiangular, therefore $H\ C$ is to $C\ B$ as $C\ O$ is to $C\ D$, or as $Q\ O$ is to $C\ D$; but $Q\ O$ is to $C\ D$ as the Decreaſe of Gravity at Q is to the centrifugal Force at C. But if $C\ B$ repreſent the centrifugal Force at C, $G\ C$ will repreſent that part of it which acts directly againſt the Force of Gravity, and conſequently the Decreaſe of Gravity at the Equator, is to the Decreaſe of Gravity at C, as $H\ C$ is to $G\ C$: Now $H\ C$ is to $G\ C$, in duplicate Proportion of $H\ C$ to $C\ B$, or of $C\ O$ or $O\ Q$ to $C\ D$, by the eighth of the ſixth of *Euclid*; and therefore the decreaſe of Gravity at Q, is to the decreaſe of Gravity at C, as the Square of $C\ O$ is to the Square of $C\ D$, which was to be demonſtrated.

From whence it is plain, that if $H\ C$ repreſent the Decreaſe of Gravity at the Equator, and $G\ C$ its Decreaſe at C, then will $G\ H$ repreſent the difference of theſe two Diminutions, or the difference between the Gravity at Q, and the Gravity at C; but $H\ G$ is the Gravity at Q, and $H\ C$ the Gravity at C, but $H\ C$ is to $H\ G$ in duplicate Proportion of $H\ C$ to $H\ B$, or of $O\ C$ to $D\ O$; that is, the Decreaſe of Gravity at the Equator, is to its Increaſe at C, as the Square of the Radius is to the Square of the Sine of the Latitude.

By this alſo it will appear, that the Direction of heavy Bodies is not to the Center of the Earth, as has been always ſuppos'd; for if we take an heavy Body and hang it by a Thread, the Thread produc'd will not paſs through the Center any where, but at the Poles and the Equator; for in the Figure the Thread is carried by the centrifugal Force of the Body B, from the Poſition $A\ C$, into the Poſition $A\ B$, where it will reſt.

Now to determine the Angle $C\ A\ B$, which the Line of Direction of the Body makes with the Line $A\ C$; Let $A\ N$ be drawn parallel to $B\ C$, and produce OB till it meet with it in N, and let the Body B be conſidered as drawn by three Powers, according to the three different Directions, BO BL, and AB; the Power which pulls it, according to BO is its Gravity, that which draws it according to its Direction BL is its centrifugal Force, and that which acts according to AB is the Strength of the Thread, by which the Body is hindred from moving according to either of the two Directions, and therefore it is in an *Æquilibrium* with the other two Powers: But by a *Theorem* which is demonſtrated by ſeveral Writers in *Mechanicks*, but more particularly by Monſ. *Hugens*, in his Small Treatiſe, *De potentiis per Fila trahentibus*; if a Body be pulled by three different Powers which are in *Æquilibrio* with one another according to three different Directions, AB, BL, and BO, theſe three Powers will be as the three Sides of the Triangle ABN, viz. as AB, AN, and NB, reſpectively, or as AB, BC, and AC, being very near parallel, and conſequently equal to AC; ſince they do not meet but at a great diſtance. From hence it follows, that the Force of Gravity is to the centrifugal Force as AC to BC. But a Method has been already ſhown, how the Proportion of the Force of Gravity to the centrifugal Force may be determined, and therefore, the Proportion of AC to BC, may be alſo determined, which at the Latitude of 51°, 40′, is as 446 to 1: Therefore in the Triangle ABC, the Proportion of AC to BC is known, and the Angle ACB being equal to the Angle COQ, which is ſubtended by the Arch CQ, the Latitude of the Place; from thence by the Tables of Sines and Tangents, the Angle BAC may be known, which in the Latitude above-mentioned, is above five Minutes.

From hence alſo it will appear, that it is not the Line AB which being produc'd, paſſes through the Center, but the Line AC, that is perpendicular to the Curve PQ; for all the Particles of the Fluid will ſettle themſelves in ſuch a Poſition, that their Lines of Direction downwards, muſt be perpendicular to the Surface of the Body which they compoſe; for othewiſe, the Parts of the Fluid would not be in *Æquilibrium* one with another; and therefore, altho' the Lines of Direction of heavy Bodies do not paſs through the Center of the Earth, yet are they ſtill perpendicular to their Horizons; and, upon this account, there cou'd ariſe no Error in levelling of Lines, and in finding the Riſings and Fallings of the Ground.

Upon this account alſo it will appear, that the Surface of the Earth is not ſpherical, for if it were, then would all Lines drawn from the Center, be perpendicular to the Surface of the Earth, ſince it is the known Property of a Sphere that they muſt be ſo; but it has been already ſhewn, that it is the known Property of a Sphere, that they muſt be ſo; but it has been already ſhewn, that it is not ſo in the Earth; and therefore it is plain that the Earth is not a Sphere. That therefore we may enquire more particularly into the Figure of the Earth, we ſhall reſume the former *Hypotheſis*, that the Earth is compos'd of an infinite Number of Canals, which communicate with one another at the Center, and are equi-ponderant, of which we will conſider the two, as OQ, and OC, be $= r$; $OD = x$, and $DC = y$. Let the abſolute Gravity be call'd p, and the centrifugal Force at the Equator n. OC is equal to $\sqrt{x^2 + y^2}$; the Weight of the Canal OQ, is equal to the abſolute Gravity of the whole Canal *Minus*, its centrifugal Force; the centrifugal Force of each Particle is as its diſtance from the Center, and therefore it increaſes in an arithmetical Progreſſion, the greateſt of which is n; conſequently the Sum of all the centrifugal Force is equal to $\frac{1}{2} nr$; but upon the *Hypotheſis*, that Gravity is the ſame at all Diſtances from the Center; the abſolute Gravity of the Canal OQ, is pr, and therefore its real Weight upon the Center OQ, is $pr - \frac{1}{2} nr$, after the ſame manner, the abſolute Gravity of the Canal OC is $p\sqrt{x^2+y^2}$; but the Sum of all the centrifugal Forces of all the Fluids in the Canal OC is equal to the centrifugal force of the Fluid in CD, (as may be eaſily proved from the conſideration of inclined Planes) but the centrifugal Force at C being to the centrifugal Force at Q, as CD is to OQ, (that is as y is to r) the centrifugal Force at C will be equal to $\frac{ny}{r}$, and becauſe the centrifugal Force of each Particle is as its diſtance from the Point D, which is the center of the circle that the Fluid in the Canal CD deſcribes; and therefore the centrifugal Forces in counting from the Point D muſt increaſe in an arithmetical Progreſſion, the greateſt of which is $\frac{nv}{r}$ and therefore the Sum of all the centrifugal Forces in CD muſt be equal to $\frac{nyy}{2r}$, therefore the weight of the Canal OC is $= p\sqrt{x^2 + y^2} - \frac{1}{2}\frac{nyy}{r} = pr - \frac{1}{2} nr$, which equation expreſſes the nature of the Curve that is made by the Section of the Earth, with a Plane through its Poles, and by this the proportion of the axis of the Earth, to the diameter of the Equator may be eaſily determined; for when CO coincides with OP, then CD or y becomes equal to nothing, and the equation is $p\sqrt{x^2} = pr - \frac{1}{2} nr$ or $px = pr - \frac{1}{2} nr$; and therefore by the 16th of the 6th p has the ſame proportion to $p - \frac{1}{2} n$ that r has to x, or OQ to OD, but p is to $p. - \frac{1}{2} n$ as 289 is to $288\frac{1}{2}$, or as 578 is to 577, which therefore is the Proportion of the greateſt diameter of the Earth to the leaſt; but this is upon ſuppoſition that Gravity is the ſame at all diſtances from the Center; but if we will ſuppoſe, that the Gravity of Bodies without the Earth is in a proportion reciprocal to the ſquares of their diſtances from the Center, the Gravity of thoſe Bodies which are within the Earth, will be directly as their diſtances, both which do beſt agree with the obſerved *Phænomena* of Nature; then will the Gravity at the Equator be to the Gravity at the Poles as 689 to 692, which Numbers in this Hypotheſis, do alſo expreſs the Proportion of the diameter of the Earth, drawn through the Poles, to its diameter drawn in the Plane of the Equator.

It is upon the account of this Diminution of Gravity, according as we approach the Equator, that Pendulums of the ſame Length take different Times to perform their Vibrations in different Latitudes; for becauſe the accelerating Force of Gravity is leſs at the Equator than under any Parallel, and under any Parallel it is ſtill leſs, than under another which is nearer the Poles; it does from thence plainly follow, that a Body placed in the Equator, or in any other Parallel, will take a longer Time to deſcend thro' an Arch of a given Circle, than it would do at the Poles; and the farther a Body is remov'd from the Poles, the longer

Time it will take to deſcend through any given Space.

From hence it follows, that the Lengths of Pendulums which perform their Vibrations in equal Times in different Latitudes, are directly as the accelerating Forces of their Gravities; for the Time a Body takes to deſcend thro' an Arch of a Cycloid, is to the Time it will take to fall through the Axis of the Cycloid, always in a given Proportion, *viz.* as the Semi-periphery of a Circle is to its Diameter, by the 25th Propoſition of *Huygens*, *Horologium Oſcillatorium*; and therefore, when the Times in which a Body deſcends through the Axis of two differens Cycloids are equal, the Times of the Deſcent through the Cycloids will be alſo equal; but when the Times of the Deſcent through the Axis are unequal, theſe, and conſequently the Lengths of the Pendulum which vibrates in theſe Cycloids, are proportional to the accelerating Forces of their Gravities.

By this, if the Length of a Pendulum is known, which performs its Vibrations in a given Time in any one Part of the Earth, it is eaſy to determine the Length of a Pendulum which performs its Vibrations in the ſame Time in any other Part of the Earth. As for Example: The Length of a Pendulum which vibrates Seconds at *Paris*, is three Foot, eight Lines and an half, let it be requir'd to find the length of a Pendulum, which vibrates Seconds at the Equator, becauſe the Gravity at the Poles, is to the Gravity at the Equator, as 692 to 689, therefore the Decreaſe of Gravity at the Equator, is $\frac{3}{692}$ Parts of the whole Gravity; but as hath been demonſtrated before, the Decreaſe of Gravity at the Equator, is to its Increaſe in any other Latitude, as the Square of the Radius is to the Square of the Sine of the Latitude, as 1000000 to 565248; but as 1000000 is to 565248, ſo is 3.000, the Number which repreſents the Decreaſe of Gravity at the Equator, to 1.695, the Number which repreſents its Encreaſe at *Paris*, which added to 689, the Gravity at the Equator makes 690.695, the Number which will repreſent the Gravity at *Paris*. But it has been already ſhewn, that as the Gravity at *Paris* is to the Gravity at the Equator, ſo is the Length of a Pendulum which vibrates Seconds at *Paris*, to the Length of a Pendulum that vibrates Seconds at the Equator, that is, as 690, 695 to 689; ſo is 36, 708 the Length of a Pendulum at *Paris*, which performs its Vibrations in a Second to 36.616, which is therefore the length of a Pendulum, which performs its Vibrations in a Second of Time at the Equator: So that the Difference between theſe two Pendulums, is $\frac{91}{1000}$ Parts of an Inch, which comes pretty near the Obſervations of Monſ. *Richer*, who, at the Iſland of *Cayenne*, whoſe Latitude is 5° 00′, found that a Pendulum which vibrates Seconds there, was a tenth of an Inch ſhorter than a Pendulum which vibrates Seconds at *Paris*.

Thus we ſee, that the Principles and *Hypotheſis*, and withal their Conſequences, upon which the broad ſpheroidical Figure of the Earth is founded, do exactly agree in Obſervations; and therefore there is no doubt to be made, but that the Earth is really of ſuch a Figure; and that the *Hypotheſis* upon which this Figure is grounded, (*viz.* the diurnal Rotation of the Earth, and by conſequence, the centrifugal Force of all Bodies upon it) muſt be admitted for a true one; ſince the different Vibrations of Pendulums of the ſame Length in different Latitudes, can depend upon no other Cauſe; for the Change of the Air is not able to produce any ſuch Effect: For if the Air made really any Alterations in the Vibrations of a Pendulum, it would produce a quite contrary Effect than what is obſerv'd: For Pendulums near the Equator would move faſter, than they would do in Places of greater Latitude; the Air in the one Place being more rarefied, is much thinner and finer than it is in the other, and therefore gives leſs reſiſtance to Bodies that move in it.

In this reaſoning, we have ſuppos'd the Earth to have been at firſt fluid, as the *Theoriſt* has done before us; but if we will put the Caſe, that the Earth was partly fluid and partly dry, as it is at preſent, yet, becauſe we find that the Land is very near of the ſame Figure with the Sea, (only rais'd a little higher, that it might not be overflow'd) compoſing with it the ſame Solid; and it has already been ſhewn, that the ſurface of the Ocean is ſpheroidical, and not ſpherical, there is no doubt to be made, but that the Land was formed into the ſame Figure, by its wiſe Creator at the beginning of the World; for if it were otherwiſe, then would the Land towards the Equator have been overflow'd with Water, which, as has been already proved, muſt have been higher at the Equator than at the Poles; and therefore the Sea would riſe there and ſpread itſelf like an Inundation upon all the Land.

But we may compare the Experimentals and Obſervations made uſe of to confirm each of the Opinions abovementioned.

To prove Monſieur Caſſini'*s Figure of the Earth*, we muſt take the altitude of a Star nearer than two Seconds, becauſe two Seconds anſwer to 32 Joiſes on the ſurface of the Earth, and the difference of the length of Degrees is but 31. And what is more, we muſt take this Angle with an Inſtrument of 39 Inches Radius; becauſe the ten Foot Sector was only us'd at the ends of the two Parts of the Meridian.

To diſprove Monſieur Caſſini'*s Hypotheſis*, we need only obſerve, whether a Plumb-line makes an Angle of five Minutes with a perpendicular to the ſurface of ſtagnant Waters, or Lines of level.

To prove Monſieur Caſſini'*s Opinion*, the height of a great many Mountains muſt be accurately meaſured by Trigonometry, which Mathematicians have always found very difficult.

To prove Sir Iſaac Newton'*s Opinion*, we are only to meaſure one tenth of an Inch in a Rod of 39,129 Inches; and to know what to allow for the lengthening of the ſame Rod by the Summer Heat, when it is ſhut up in a Caſe and carried towards the Equator.

For tho' the Experiments on Pendulums made by ſeveral Perſons who travelled Southwards, differ among themſelves, yet they all agree in this, that the Obſervers were obliged to ſhorten their Pendulums, in order to make them ſwing Seconds, as they went towards the Equator.

And when we come to compare them together, in order to have the exact Proportion of Length in different Latitudes; we muſt rely on the moſt exact Experimenter, which we may very well do on Monſieur *Richer*, becauſe, when he found a Difference, he was ſo careful to find out how much it was, that he caus'd a ſimple Pendulum to ſwing, and compar'd it with a good Pendulum Clock, which he did ſeveral times every Week, for 10 Months together: And when he return'd to *France*, he compar'd it with the Length of a Pendulum at *Paris*, which is of 3 Feet 8½ Lines, (or 39, 129 Engliſh Inches) and found it to be ſhorter by 1¼.

EARTH. Dr. *Hook*, *in Op. Poſt. p.* 467. ſaith, that the Semi-diameter of the Earth, from the moſt accurate Obſervations that ever were made, is 3962¾ Statute Miles; or more exactly 20923500½ Statute Feet.

Since 'tis known that the Orbit of the Earth is Elliptical, and that its Motion round the Sun is ſloweſt in the *Aphelion*, and ſwifteſt in the *Perihelion*, the Conſequence is, that the Places of the Earth's *Aphelion* and *Perihelion* may be found by Obſervation of her ſloweſt or ſwifteſt Motion. And the Places of theſe *Aſpides*, as they are called, may be found alſo by the Sun's apparent Diameter; which will be leaſt when the Earth is in her *Aphelion*, and greateſt in the *Perihelion:* But there being ſome Difficulty in meaſuring this accurately, the former Way of finding the Place of the Earth's *Abſides* is the beſt.

The Motion of the Earth's *Aphelion* is only apparent, and not real; but it anſwers to the Proceſſion of the Equinoxes, which is annually about 50 Seconds.

EARTH. In the Year 1679, an Experiment being ſuggeſted to try, whether the Earth moved with a Diurnal Motion or not, by the Fall of a Body from a conſiderable Height, alledging it would fall to the *Eaſt* of a true Perpendicular; Dr. *Hook* read before the R. Society a Diſcourſe on that Subject, wherein he endeavoured to explain, what Curve the falling Body would deſcribe; and in particular, he aſſerted, that the Fall of the Body would not be directly *Eaſt*, but to the *South-Eaſt*, and more to the *South* than to the *Eaſt.* And on ſeveral Trials made, the Ball did always fall to the *South-Eaſt. Hock's Life, in Ob. Poſt. p.* 22.

EARTH. According to Sir *Iſaac Newton's* Principles, *Lib.* 3. *Prop.* 21. *The Axis of the Earth* doth, in every annual Revolution of the Earth round the Sun, *twice incline towards the Ecliptick*, and twice return to its former Poſition; and on this *Nutation of the Earth's Axis*, depends the Receſſion of the Equinoctial Points; and, as Mr. *Flamſtead* thinks, the annual Parallax of the fixed Stars.

The Annual Regreſſion of the Earth's Nodes, is about 50 Seconds, and the Nutation of her Axis about 42 Thirds.

EAREH. Dr. *Gregory*, *Aſtron. Phyſ. & Geom. p.* 76. That by reaſon of the Figure of the Earth, the Equinoctial Points do *recede*; and that the Axis of the Earth, in every one of its annual Revolutions round the Sun, doth twice change its Inclination to the Ecliptic, and as often return again to its former Inclination of 66 Deg. and half.

EARTH, which the Chymiſts call *Terra Damnata*, and *Caput Mortuum*, is the laſt of the five Chymical Principles, and is that which remains after all the other Principles are extracted by Diſtillation, Calcination, *&c.*

EARTH-BAGS, in *Fortification*, the ſame with *Canvas-Bags.* Which ſee.

EARTHQUAKES. Mr. *Boyle* thinks that *Earthquakes* are often occaſioned by the ſudden fall of ponderous Maſſes in the Hollow Parts of the Earth, whereby thoſe terrible Shocks and Shakings are produced.

The Learned Dr. *Woodward*, in his Eſſay towards a Natural Hiſtory of the Earth, gives the following Account of *Earthquakes*; which is much the beſt of any I have ſeen.

He ſuppoſes the ſubterranean Heat or Fire, which is continually elevating Water out of the Abyſs, to furniſh the Earth with Rain, Dew, Springs, and Rivers, when it is ſtopped in any part of the Earth, and ſo diverted from its ordinary Courſe, by ſome accidental Glut or Obſtruction in the Pores or Paſſages through which it uſed to aſcend to the Surface, becomes by this means preternaturally aſſembled, in a greater quantity than uſual, into one Place; and therefore cauſes a great rarefaction and intumeſcence of the Water of the Abyſs, putting it into very great Commotions and Diſorders, and at the ſame time making the like effort on the Earth, which is expanded upon the face of the Abyſs; and that this occaſions that Agitation and Concuſſion of it, which we call an *Earthquake.*

That this Effort is in ſome *Earthquakes* ſo vehement that it ſplits and tears the Earth, making Cracks and Chaſms in it ſome Miles in length, which open at the Inſtant of the Shock, and cloſe again in the Intervals betwixt them; nay, 'tis ſometimes ſo extreamly violent, that it plainly forces the ſuperincumbent *Strata*, breaks them all throughout, and thereby perfectly undermines and ruins the Foundation of them; ſo that theſe failing, *the whole Tract*, as ſoon as ever the Shock is over, ſinks down to rights into the Abyſs underneath, and is ſwallowed up by it, the Water thereof immediately riſing up, and forming a Lake in the Place where the ſaid Tract before was.

That ſeveral conſiderable Tracts of Land, and ſome with Cities and Towns ſtanding upon them; as alſo whole Mountains, many of them very large, and of great height, have been thus totally ſwallowed up.

That this Effort being made in all Directions indifferently, upwards, downwards, and on every ſide, the Fire dilating and expanding on all hands, and endeavouring proportionably to the Quantity and Strength of it, to get room, and make its way thro' all Obſtacles, falls as foul upon the *Water of the Abyſs* beneath, as upon the Earth above, forcing it forth which way ſoever it can find Vent or Paſſage, as well through its ordinary *Exits*, *Wells*, *Springs*, and the Outlets of *Rivers*, as through the Chaſms then newly opened; through the *Camini* or *Spiracles* of *Ætna*, or other near *Vulcano's*; and thoſe *Hiatus* at the bottom of the Sea, whereby the *Abyſs* below opens into it, and communicates with it.

That as the Water reſident in the *Abyſs*, is, in all Parts of it, ſtored with a conſiderable Quantity of Heat, and more eſpecially in thoſe where theſe extraordinary Aggregations of this Fire happen; ſo likewiſe is the Water which is thus forced out of it, inſomuch that when thrown forth, and mixed with the *Waters* of *Wells*, of *Springs*, of *Rivers*, and the *Sea*, it renders them very ſenſibly hot.

That it is uſually expelled forth in vaſt Quantities, and with great Impetuoſity, inſomuch that it hath been ſeen to ſpout out of deep *Wells*, and fly forth at the Tops of them upon the Face of the Ground; with like rapidity comes it out of the Sources of *Rivers*, filling them ſo of a ſudden, as to make them run over their *Banks*, and overflow their *Neighbouring Territories*, without ſo much as one drop of Rain falling into them, or any other concurrent Water to raiſe and augment them.

That it ſpews out of the *Chaſms* opened by the Earthquake in great abundance, mounting up in mighty Streams to an incredible Height in the Air, and this oftentimes at many Miles Diſtance from any Sea.

That it likewiſe flies forth of the *Vulcano*'s in vaſt Floods, and with wonderful Violence: That 'tis forced through the *Hiatus*'s at the Bottom of the Sea with ſuch Vehemence, that it puts the Sea immediately into the moſt horrible Diſorder and Perturbation imaginable, even when there is not the leaſt Breath of Wind ſtirring, but all till then calm and ſtill, making it rage and roar with a moſt hideous and amazing Noiſe, raiſing its Surface into prodigious Waves, and toſſing and rowling them about in a very ſtrange and furious manner; overſetting Ships in the Harbours, and ſinking them to the Bottom, with many other like Outrages.

That 'tis refunded out of theſe *Hiatus*'s in ſuch Quantity alſo, that it makes a vaſt Addition to the Water of the Sea, raiſing it many Fathoms higher than ever it flows in the higheſt Tides, ſo as to pour it forth far beyond its uſual Bounds, and make it overwhelm the adjacent Country; by this means ruining and deſtroying Towns and Cities, drowning both Men and Cattle; breaking the Cables of Ships, driving them from their Anchors, bearing them along with the Inundation ſeveral Miles up into the Country, and there running them aground; ſtranding Whales likewiſe, and other great Fiſhes, and leaving them at its return upon dry Land.

That theſe *Phænomena* are not new, or peculiar to the Earthquakes which have happened in our Times, but have been obſerved in all Ages, and particularly theſe exorbitant Commotions of the Water of the Globe.

This we may learn abundantly from the Hiſtory of former Times; and 'twas for this reaſon, that many of the Ancients concluded rightly enough, that they were cauſed by the Impulſes and Fluctuation of Water in the Bowels of the Earth; and therefore they frequently called *Neptune*, Σεισίχθων, as alſo Ἐκινησίχθων, Ἐνοσίγαιος, and Τινακτογαίης; by all which Epithets they denoted his Power of ſhaking the Earth.

They ſuppoſed that he preſided over all Water whatever, as well that within the Earth as the Sea, and the reſt upon it; and that the Earth was ſupported by Water, its Foundations being laid thereon; on which Account it was, that they beſtow'd upon him that Cognomen Γαιήοχος, or *Supporter of the Earth*, and that of Θεμελιοῦχος, or, *The Suſtainer of its Foundations.*

They likewiſe believed, that he having a full Sway and Command over the Water, had Power to ſtill and compoſe it, as well as to move and diſturb it, and the Earth by means of it; and therefore they alſo gave him the Name of Ἀσφέλιος, or, *The Eſtabliſher*; under which Name ſeveral Temples were conſecrated to him, and Sacrifices offered, whenever an Earthquake happen'd, to pacify and appeaſe him, requeſting that he would allay the Commotions of the Water, ſecure the Foundations of the Earth, and put an end to the Earthquake.

That the Fire it ſelf, which being thus aſſembled and pent up, is the Cauſe of all theſe Perturbations, makes its own way alſo forth, by what Paſſages ſoever it can get vent, through the Spiracles of the next *Vulcano*'s, through the Cracks and Openings of the Earth above mentioned, through the Apertures of Springs, eſpecially thoſe of the *Thermæ*, or any other way that it can either find or make; and being thus diſcharged, the Earthquake ceaſeth till the Cauſe returns again, and a freſh Collection of this Fire commits the ſame Outrages as before.

That there is ſometimes in Commotion a Portion of the Abyſs of that vaſt Extent, as to ſhake the Earth incumbent upon it for ſo very large a Part of the Globe together, that the Shock is felt the ſame Minute preciſely in Countries that are many Hundreds of Miles diſtant from each other; and this, even though they happen to be parted by the Sea lying betwixt them: And there want not Inſtances of ſuch an Univerſal Concuſſion of the whole Globe, as muſt needs imply an Agitation of the whole Abyſs.

That though the Abyſs be liable to theſe Commotions in all Parts of it, and therefore no Country can be wholly exempted from the Effects of them; yet theſe Effects are no where very remarkable, nor are there uſually any great Damages done by Earthquakes, except only in thoſe Countries which are Mountainous, and conſequently Stony and Cavernous underneath, and eſpecially where the Diſpoſition of the *Strata* is ſuch, that thoſe Caverns open into the Abyſs, and ſo freely admit and entertain the Fire, which aſſembling therein, is the Cauſe of the Shock; it naturally ſteering its Courſe that Way where it finds the readieſt Reception, which is towards thoſe Caverns, this being indeed much the Cauſe of Damps in Mines. Beſides, that thoſe Parts of the Earth which abound with *Strata* of Stone or Marble, making the ſtrongeſt Oppoſition to this Effort, are the moſt furiouſly ſhattered, and ſuffer much more by it, than thoſe which conſiſt of Gravel, Sand, and the like laxer Matter, which more eaſily give way, and make not ſo great Reſiſtance; an Event obſervable not only in this, but all other Exploſions whatever.

But above all, thoſe Countries which yield great Store of Sulphur and Nitre, are, by far, the moſt injured and incommoded by Earthquakes; thoſe Minerals conſtituting in the Earth a kind of Natural Gunpowder, which taking Fire upon this Aſſembly and Approach of it, occaſions that murmuring Noiſe, that Subterranean Thunder which is heard rumbling in the Bowels of the Earth during Earthquakes, and by the Aſſiſtance of its exploſive Power, renders the Shock much greater, ſo as ſometimes to make miſerable Havock and Deſtruction.

And 'tis for this Reaſon that *Italy*, *Sicily*, *Anatolia*, and ſome Parts of *Greece*, have been ſo long and ſo often alarm'd and haraſs'd by Earthquakes, theſe Countries being all Mountainous and Cavernous, abounding with Stone and Marble, and affording Sulphur and Nitre in great Plenty.

That *Ætna*, *Veſuvius*, *Hecla*, and the other *Vulcano*'s, are only ſo many Spiracles ſerving for the Diſcharge of this Subterranean Fire, when 'tis thus preternaturally aſſembled. That where there happens to be ſuch a Structure and Conformation of the interior Parts of the Earth, as that the Fire may paſs freely, and without Impediment from the Caverns wherein it aſſembles, unto thoſe Spiracles, it then readily and eaſily gets out, from time to time, without ſhaking or diſturbing the Earth: But where ſuch Communication is wanting, or Paſſages not ſufficiently large and open, ſo that it cannot come at the ſaid Spiracles without firſt forcing and removing all Obſtacles, it heaves up and ſhocks the Earth with greater or leſſer Impetuoſity, according as the Quantity of Fire thus aſſembled is greater or leſs, till it hath made its way to the Mouth of the *Vulcano*, where it ruſheth forth ſometimes in mighty Flames, with great Velocity, and a terrible bellowing Noiſe.

That therefore there are ſcarcely any Countries that are much annoyed with Earthquakes, that have not one of theſe Fiery Vents, and theſe are conſtantly all in Flames when any Earthquake happens, they diſgorging that Fire which, whilſt underneath, was the Cauſe of the Diſaſter; and were it not for theſe *Diverticula*, whereby it gains an *Exit*, 'twould rage in the Bowels of the Earth much more furiouſly, and make greater Havock than now it doth.

So that though thoſe Countries where there are ſuch *Vulcano*'s, are uſually more or leſs troubled with Earthquakes, yet were theſe *Vulcano*'s wanting, they would be more troubled with them than now they are; yea, in all probability, to that Degree, as to render the Earth for a vaſt Space around them perfectly uninhabitable.

In one word, ſo Beneficial are theſe to the Territories where they are, that there do not want Inſtances of ſome which have been reſcued and wholly delivered from Earthquakes by the breaking forth of a new *Vulcano* there, this continually diſcharging that Matter, which being till then barricado'd up and impriſoned in the Bowels of the Earth, was the occaſion of very great and frequent Calamities.

That moſt of theſe Spiracles perpetually, and at all Seaſons, ſend forth Fire more or leſs; and though it be ſometimes ſo little that the Eye cannot diſcern it; yet, even then, by a nearer approach of the Body, may be diſcovered a copious and very ſenſible Heat continually iſſuing out.

EASE, in the Sea Phraſe, is the ſame as *ſlack*, or let go ſlacker: Thus, they ſay *Eaſe the Bowling*, *Eaſe the Sheet*, i. e. *let it go ſlacker.*

EASEL-*Pieces*, in Painting, are ſuch ſmall Pieces, either Portraits or Landskips, which are painted on the *Eaſel*; (the Frame on which the Painter places his ſtrain'd Canvaſs) and are ſo called to diſtinguiſh them from larger Pictures, which are drawn on Cielings, Roofs, or the Walls of Rooms.

EASEMENT, *(Aiſiamentum)* in the Law, is a Service which one Neighbour hath of another, by Charter or Preſcription, without Profit; as a Way through his Ground, a Sink, *&c.* and this, in the Civil Law, is called *Servitus Prædii.*

EAVES-LATH, in Architecture, is a thick ſeather-edg'd Board, nail'd round the Eaves of a Houſe, for the lowermoſt Tiles, Slate, or Shingles to reſt upon.

EBBING and *Flowing* of the Sea: See *Tides.*

EBDOMADARIUS, was formerly an Officer, ſo called in Cathedral Churches, appointed Weekly to ſuperviſe the regular Performance of Divine Service, and other Duties of the Choir; and at the Beginning of each Week he drew up a Bill (which was called *Tabula*) of the reſpective Perſons attending the Service of the Choir, and of their Duties allotted them; and thoſe Perſons which were entered in this Bill were called *Intabulati.*

EBULLITION: The great Boiling, Struggling or Effervеſcence, which ariſes upon the mingling together of an Acid and an Alkalizate Liquor; and from hence any inteſtine violent Motion of the Parts of a Fluid, occaſioned by the ſtruggling of Particles of different Natures, is called by this Name, *Ebullition.*

That a conſiderable *Ebullition* may be produced without Heat, *(da veniam verbo)* nay, that a Degree of Cold may be produced greater than was in either of the Bodies ſingly, and that it ſhall ariſe purely upon their Mixture, though accompanied with a great Struggle, Tumult, Noiſe and Froth;

Mr. *Boyle* plainly proves from this Experiment:

He ſhook one Part of Oil of Vitriol into 12 Parts of common Water; the Mixture was at firſt ſenſibly warm: Then the Ball of a Thermoſcope was placed within it, till the included Spirit had gained the Temperament of the Mixture: But then a convenient Quantity of Volatile Salt of Sal Armoniack being gradually put in, to ſatiate the acid Spirits of the Mixture, the Spirit in the Thermoſcope deſcended above an Inch.

ECBOLICA [Εκβολικὰ of εκβάλλω Gr. to caſt out] are Medicines which help the Delivery in hard Labour: Alſo Medicines which cauſe Abortives. *Blanchard.*

ECCENTRICITY [of *Eccentricus*, L.] in the *Ptolemaick Aſtronomy*, is that Part of the *Linea Apſidum* lying between the Center of the Earth and of the Eccentrick, *(i. e.)* that Circle which the Sun is ſuppoſed to move in about our Earth, and which has not the Earth exactly for its Center: And the Ancients found this muſt be ſuppoſed, becauſe the Sun ſometimes appears large, and then it is neareſt to us, and ſometimes ſmaller, and then further of.

ECCENTRICITY *of the Earth*, in the new Aſtronomy, is the Diſtance between the Focus and the Center of the Earth's Elliptick Orbit: How to find which, Mr. *Whiſton* ſhews, *p.* 90. of his *Prælect. Aſtron.* from the apparent Motion of the Sun, compared with the two Extreams of the *Apſides*. For ſince the *true Velocity* of the Earth in her *Aphelion* and *Perihelion* is in a *reciprocal Ratio* of her Diſtances from the Sun; and that the *apparent* and *angular Velocity* is in a duplicate Ratio of her Diſtances reciprocally; from the apparent Difference of theſe two Velocities, the Difference of the Diſtances, or the double Eccentricity, will eaſily be known. The Eccentricity of the whole Diſtance is, at a mean, about a 60th Part, or, more accurately, $\frac{3486}{100000}$.

ECCENTRICITY *Simple* or *Single*, in the new *Elliptical Aſtronomy*, is the Diſtance between the Center of the *Ellipſe* and the *Focus*; or between the Sun and the Center of the Eccentrick.

ECCENTRICITY *Double*, is the Diſtance between the *Foci* in the *Ellipſe*, and is equal to twice the Single Eccentricity.

ECCENTRICK *Circles*, are Circles not having the ſame Center. Of which Kind ſeveral Orbits were invented by ancient Aſtronomers, to ſolve the Appearances of the Celeſtial Bodies.

The Eccentricks of the Planets they called alſo *Deferents*, becauſe they ſeemed to carry the Body of the Planet round in their Circumferences.

ECCENTRICK *Equation*, in the old Aſtronomy, is an Angle made by a Line drawn from the Center of the Earth, and another drawn from the Center of the Eccentrick, to the Body or Place of any Planet; the ſame with the *Proſtaphæreſis*; and is equal to the Difference (accounted in an Arch of the Eccliptick) between the Sun's or Planets real and apparent Place.

ECCENTRICK *Place of a Planet*, is that very Point of the Orbit, where the Circle of Inclination coming from the Place or a Planet in his Orbit, falls thereon with right Angles.

In *Philoſoph. Tranſact. N.* 37. there is a Geometrick Method of Signior *Caſſini* for finding the Eccentricities of the Planets.

And in *N.* 28. there is another Direct and Geometrical Method for finding the *Aphelions*, *Eccentricities* and *Proportions* of the Orbits of the Primary Planets. By Mr. *Halley*.

ECCOPROTICA, the ſame with *Catharticum.*

ECCHYLOMA, the ſame with *Extractum.*

ECCHYMOMA [of 'Εκχύμωμα, Gr.] are Marks and Spots in the Skin, ariſing from the Extravaſation of Blood. *Blanchard.*

ECCHYMOSIS ['Εκχύμωσις of χυμος Juice, Gr.] the ſame with *Ecchymoma.*

ECCOPE ['Εκκοπὴ, Gr.] the ſame with *Extirpatio.*

ECCRIMOCRITICA, are Signs to judge of a Diſtemper from particular Excretions. *Blanchard.*

ECCRISIS ["Εκκρισις of ἐκκρίνω, Gr. to ſeparate] is a Secretion of Excrements out of an Animal Body, or out of ſome Part of it.

ECCLISIS [of ἐκκλίνω, Gr. to turn aſide, of ἐκ and κοπρω, Gr. Dung.]

ECHINOPTHALMIA [of 'Εχῖνος a Sea Hedgehog, and ὀπθαλμία, Gr. a diſeaſe in the Eye,] an inflammation of the Eye-lid.

ECHINUS, among the Botaniſts, is the prickly Head, Cover of the Seed, or Top of any Plant: So called from its Likeneſs to a Hedge-hog.

ECHINUS, in Architecture, is a Member or Ornament, firſt placed on the Top of the *Ionick Capitals*, taking its Name from the Roughneſs of the Carving, reſembling the prickly Rind of the Cheſnut, and not unlike the Thorny Coat of a Hedge-hog.

This Ornament is made uſe of by Modern Architects in Cornices of the *Ionick*, *Corinthian* and *Compoſite* Orders, and generally ſet next to the *Abacus*, being carved with Anchors, Darts and Ovals, or Eggs; whence 'tis called *Ove* by the *French*, and *Ovolo* by the *Italians*; but the *Engliſh* Workmen commonly call it the *Quarter round.*

ECHO. Dr. *Plot*, in his Natural Hiſtory of *Oxfordſhire*, *Cap.* 1. diſtinguiſhes Echoes into ſuch as are, 1. *Single*, which return the Voice but once; and of theſe, ſome may be called *Tonical*; becauſe they will not return the Voice but when modulated into ſome peculiar Muſical Note: And others, *Polyſyllabical*; becauſe they will return many Syllables, Words, and Sentences; and ſometimes a whole Hexameter Verſe.

2. *Manifold* or *Tautological*, which return Syllables and Words the ſame oftentimes repeated.

In the *Polyſyllabical* and *Articulate* Echoes, the Place where the Speaker ſtands is called the *Centrum Phonicum*; and the Object or Place that returns the Voice is called the *Centrum Phonocampticum.* He ſaith, he experienced what *Blancanus* writes in his *Echometria*, *Theor.* 5. That no one Syllable can be diſtinctly and clearly returned under the Diſtance of 24 Geometrical Paces, or 120 Feet. But by ſome Experiments I have made, I judge that Diſtance to be too large, as well as that of *Merſenus*, of 69 Feet, to be too little: And perhaps ſome Places may return the Voice ſooner, and ſome later, than others; which it would be worth while to try, where there is a Convenience of meaſuring perpendicularly from the *Centrum Phonocampticum.* When I was about 16 Years of Age, having Dr. *Plot*'s Book to direct me, I remember well, that I found an Echo, whoſe *Centrum Phonicum* was on the North Side of *Shipley* Church, in the Wild of *Suſſex*; and which would repeat diſtinctly theſe Words, in the Night;

> *Os Homini ſublime dedit, Cœlumque tueri*
> *Juſſit & Erectos* ——

eſpecially if you ſpoke the firſt Syllable very ſtrong, and all the reſt pretty faſt. I meaſured then alſo the Diſtance very accurately, but the Papers are loſt, and I can pronounce nothing certainly about them; but only that it was much the fineſt and moſt diſtinct Echo that ever I tried; tho' I tried the famous one at *Woodſtock* ſeveral Times, after I went to *Oxford.*

ECLEGMA ['Εκλειγμα of ἐκλείχω, Gr. to lick off,] the ſame with a *Linctus Lambativus*, *Loch*, or *Lohoch*, being a Medicine deſign'd to heal or eaſe the Lungs in Coughs, Peripneumonies, *&c.* being uſually compoſed of Oils and Syrups, and ſometimes Powders incorporated together into a Conſiſtence thicker than a Syrup, but not ſo thick as an Electuary.

ECLIPSE ['Εκλειψις of ἐκλείπω, Gr. to leave or forſake,] is a Deprivation of the Light of one of the Luminaries, when by their Conjunction in the Orbit of the Sun, or in the Ecliptick, his Face, by the interpoſition of the *Moon*'s Body, is hidden from our Sight; or when by their Oppoſition in the ſame Orbit, the *Moon*, by the Shadow of the intervening Earth, is obſcured.

So that in a Lunar *Eclipſe*, ſhe really loſes her Light, and is obſcured, by wanting the Illumination of the Sun either totally or partially. But in an *Eclipſe* of the Sun, he loſes not his Light, but only we are deprived of it in part by the interpoſition of the *Moon*'s Body between us and the Sun: And therefore this ought rather to be called an *Eclipſe* of the Earth; for 'tis the Earth that is deprived of Light, and not the Sun.

A Central *Eclipſe* of the *Moon*, is, when not only the entire Body of the *Moon* is covered by the Shadow, (which is a Total one; as when it is covered by it in Part, it is called a Partial one) but alſo the Center of the *Moon* paſſes through the Center of that Circle, which is made by a Plane cutting the Cone of the Earth's Shadow at Right Angles with the Axis, or with that Line, which joins the Centers of the Sun and the Earth.

For the Method of Calculation of the Eclipſes of both the Luminaries, ſee Dr. *Gregory*'s Aſtronomy, *Book* IV. *Sect.* 7 and 8; and Mr. *Flamſtead*'s Doctrine of the Sphere, in *Moor*'s Mathematicks, Part the Second.

Becauſe the Earth (or Sun) always moves in the Ecliptick, the *Moon* can never be Eclipſed, but when her *Plenilunium* happens in or near her *Nodes*, (that is, in the interſection of the Plane of the Orbit with that of the Ecliptick.)

The Shadow of the Earth obſcuring the *Moon*, though projected into a Cone of a vaſt Length, yet reaches not ſo far as the Planet *Mars*, for he is never Eclipſed by it, tho' he be in the Plane of the Ecliptick, and at Oppoſition to the Sun.

If the *Moon* be ſo near the *Node*, that the Aggregate of the apparent Semi-diameters of the

Moon and of the Earth's Shadow be greater than the *Moon*'s Latitude, ſhe will be Eclipſed, otherwiſe not. And becauſe the Sum of the Semi-diameters of the *Moon* and of the Earth's Shadow, are always greater than *that* of the Semi-diameters of the *Sun* and *Moon*; for the former is never leſs than 53′, and the latter never greater than 35′, 'tis plain, that *Lunar Eclipſes* may happen in a greater Latiude of the Moon, or when ſhe is farther from the *Node* than *Solar* ones; and in this reſpect, of one and the ſame Place upon the Earth, will more often become viſible there; though in regard to the View of the whole Earth, the ſolar Eclipſes will happen more frequently.

Our moſt accurate Aſtronomer Mr. *Flamſtead*, in the Second Part of his excellent Doctrine of the Sphere, which is Printed in the Firſt Vol. of Sir *Jonas Moor*'s Mathematicks, gives you an Orthographick Projection of the Sphere on a Plane touching the Moon's Orbit, at Right Angles to the Line connecting the Centers of the Earth, Sun, or given Star, by Right Lines proceeding from any of them to the Sphere, whereby are determined the Moon's Parallaxes in Altitude, Longitude, and Latitude; and by it he ſhews alſo how to determine the Breadth of the Semi-diameter of the Diſk of the Penumbra, and the Earth's Shadow in an Eclipſe, and how that of the Sun is made.

He teaches alſo very briefly and plainly, how the true Places of the Sun and Moon, her Latitude, Horary Diſtance, Horizontal Semi-diameters and Parallaxes may be found by Calculation; as alſo, how to find the ſame way, the Times of the mean and true Conjunctions or Oppoſitions of the Luminaries: as alſo, the principal Phaſes of a Solar Eclipſe for the Meridian of *London*, with the Longitudes from it, and the Latitudes of ſuch Places as the Eclipſe will be ſeen at, or where the ſaid Phaſes ſhall appear; that is, where the Eclipſe begins in the Vertex of the Riſing, or ends in the Vertex of the Setting Sun: Where he riſes or ſets Centrally Eclipſed; where the Eclipſe ends in the loweſt Point of the Riſing, or begins in the loweſt Point of the Sun Setting; where the Sun is Centrally Eclipſed in the Meridian; and to mention no more, where the Sun is Centrally Eclipſed in the Nonageſimal Degree, without the help of Nonageſimary Tables; of which he gives an Example, and demonſtrates the Reaſon of the *Calculus*.

He gives there alſo, a Geometrical Conſtruction of Eclipſes, ſhewing how to find the exact Conjunction, &c. of the Luminaries, Digits when darkned, Inclination of the *Cuſps*, End of the Eclipſe, or Time when any poſſible Number of Digits ſhall be darkned, by Scale and Compaſs; all which is done with great Plainneſs, Brevity and Accuracy, and is very well worth the Mathematical Reader's Peruſal.

ECLIPSE *of the Sun.* In order to obſerve an Eclipſe of the Sun accurately, Mr. *Flamſtead* directs, to caſt the Species of the Sun through a good Teleſcope, of a tolerable length, on an extended Paper behind the Eye-glaſs; and ſo far as that the ſaid Species may appear at leaſt 6 Inches over: And then to divide both the Periphery of a Circle, equal to that, and drawn on a Paper, into 360 gr. for the better obſerving the Cuſps of each Phaſis; and alſo the Diameter into Digits, and their Parts, by concentrick Circles, for meaſuring the Quantity of the obſcured Parts. When you look at an Eclipſe of the Sun, the beſt and readieſt way to ſave the Eye, is to take a Piece of plain Looking-glaſs Plate, and black one ſide of it over the Flame of a Candle; and then look through it at the Sun. And if you uſe a Teleſcope, ſuch a black'd Glaſs muſt be between your Eye and the Eye-glaſs.

To determine the Moment of the Immerſion, Duration, and other Requiſites of a ſolar Eclipſe, *Vid. Whiſton*'s *Prælect. Aſtron. p.* 160. and of a lunar, *p.* 150.

ECLIPSES. 'Tis now diſcovered, that lunar Eclipſes do not ariſe from the interpoſition of the Earth's Body between the Sun and her, but only from the interpoſition of its Atmoſphere.

Of which, and all the *Phænomena* of Eclipſes, See *Whiſton*'s *Prælect. Aſtron. p.* 135.

ECLIPSIS, in a Medicinal Senſe, is a Defection of the Spirits, or Fainting, or Swooning.

ECLIPTICK ['Εκλειπτικὸς, Gr.] is a great Circle of the Sphere, ſuppoſed to be drawn through the middle of the Zodiack, (which ſee) and making an Angle with the Equinoctial (in the Points of *Aries* and *Libra*) of 23°. 30′. which is the Sun's greateſt Declination.

This is by ſome called *Via Solis*, or the Way of the Sun, becauſe the Sun, in his annual Motion, never deviates from this Line, as all the other Planets do more or leſs; from whence the Zodiack hath its Breadth. 'Tis this Line which is drawn on the Globe, and not the Zodiack; but in the New Aſtronomy, the *Ecliptick* is that Path or Way among the fix'd Stars, which the Earth appears to deſcribe to an Eye placed in the Sun, as in its annual Motion it runs round the Sun from Weſt to Eaſt: And if you ſuppoſe this Circle to be divided into 12 equal Parts, they will be the 12 Signs, each of which is denoted or diſtinguiſhed by ſome Aſteriſm or Conſtellation.

> *Note*, If the Spectator's Eye be ſuppoſed to be on the Earth, the Sun will appear always to be in the oppoſite Sign to what the Earth is in.

ECLYSIS ["Εκλυσις of ἐκλύω, Gr. to diſſipate,] is when the Strength of the Patient is a little decayed, proceeding from a want of a ſufficient Warmth and Spirits in the Body. *Blanchard.*

ECPHRACTICUM ['Εκφρακτικὸν of ἐκφράσσω, Gr. to remove Obſtruction,] is a Medicine good againſt Obſtructions.

ECPHRAXIS ['Εκφραξις of ἐκφράσσω Gr.] is a taking away of Obſtructions in any Part. *Blanchard.*

ECPHYSESIS ['Εκφύσεσις of ἐκφύω, Gr. to grow out,] is a Diſeaſe in which the Patient breathes thick.

ECPHYSIS ["Εκφυσις, Gr.] is any Proceſs that coheres with, or adheres to a Bone.

ECPIEMA ['Εκπίεμα, Gr.] the ſame with *Empiema.*

ECPIESMA ['Εκπίεσμα of ἐκπιέζω, Gr. to ſqueeze out,] is a Juice ſqueezed out; alſo the Dregs which remain of any Thing that is ſqueezed; likewiſe a Fracture of the Skull, wherein the broken Parts preſs upon the Meninges or Skin of the Brain. *Blanchard.*

ECPIESMUS ['Εκπιεσμὸς, Gr.] is a very great Protuberance of the Eyes.

ECPLEXIS ["Εκπληξις, Gr.] is a Fright or Stupor.

ECPNEUMATOSIS [of 'Εκπνευματόω, Gr. to breathe out,] the ſame as *Expiration.*

ECPTOSIS [Ἔκπτωσις, Gr. a falling down,] the ſame as *Luxation.*

ECPUCTICA [Ἐκπυκτικὰ of ἐκπύκω, Gr.] condenſing Medicines; ſee *Incraſſantia.*

ECPYSESIS, ſee *Empyema.*

ECRITHMUS [of ἐκ and ῥυθμὸς, Gr.] a Pulſe which obſerves no method or number, incident to any Age. *Blanchard.*

ECTHLIMMA [Ἐκθλίμμα, Gr.] an Ulceration ariſing from a violent Compreſſion in the Surface of the Skin. *Blanchard.*

ECTHLIPSIS [Ἐκθλιψις of ἐκ and θλίβω, Gr. to daſh out,] is a Figure in Grammar relating to the Dimenſion of *Latin* Verſes, whereby the Letter *m*, with its preceding Vowel, is cut off, becauſe the ſucceeding Word begins with a Vowel, as in this Verſe;

O Curas Hominum! O quantum eſt in Rebus Inane!

Where the *um* in *Hominum* and *Quantum* is entirely cut off, and not ſounded before the Vowels *o* and *e*.

ECPTOMA [of ἐκ and πίπτω, Gr. to fall,] a Luxation.

ECSARCOMA [Ἐκσάρκομα of ἐκ and σὰρξ, Gr. Fleſh,] any fleſhy Excreſcence.

ECTHYMATA [Ἐκθυματὰ, Gr.] are Pimples or certain breakings out of the Skin, as the Small Pox, &c. *Blanchard.*

ECTHYMOSIS [of Ἐκθυμος, Gr.] is a Commotion or Intumeſcence of the Blood; alſo a Cheerfulneſs of the Mind. *Blanchard.*

ECTILLOTICA [of Ἐκτίλλω, Gr. to pluck,] are Medicines which conſume callous Parts, and pull out Hairs, &c. *Blanchard.*

ECTROPIUM [Ἐκτρόπιον, Gr.] is a growing of the Eye-lids, when the lower is ſhorter than the upper. *Blanchard.* Or,

ECTROPIUM [of ἐκτρέπω, Gr. to turn down,] an Excreſcence under the Eye-lid, which by its weight turns it downwards.

ECTROSIS [Ἔκτρωσις of ἐκτιτρώσκω, Gr. to render abortive,] an Abortion.

ECTYPE [Ἔκτυπον, Gr.] with Antiquaries, an Impreſſion of a Medal, Seal or Ring; or a figured Copy of an Inſcription, or other ancient Monument.

ECZEMATA [Ἐκζέματα, Gr.] are extreme hot, or, as it were, burning Pimples: Some take *Hydroa* for *Eczemata*, but it is a Miſtake. *Blanchard.*

EDDY, is when the Water at any Place runs back, contrary to the Tide or Stream, and ſo falls into the Tide or Current again. The Seamen call alſo that *Eddy Water*, which falls back, as it were, on the Rudder of a Ship under Sail, the *Dead Water.* They call alſo an *Eddy Wind*, that which returns, or is beat back from any Sail, &c.

EDICT, in the Civil Law, is any thing that the Emperor eſtabliſhes of his own accord, that it may be generally obſerved by every Subject. And this differs both from a *Decree*, or a *Pragmatick Sanction.*

EDULCORATION, (*i.e.* Sweetning) is a Term uſed by the Chymiſts for the clearing of any Matter from the Salts it may be impregnated or mixted with, by waſhing it throughly in common Water.

EFFECTIONS, is a Word uſed by Geometers, in the ſame Senſe with the *Geometrical Construction* of Propoſitions, and often of *Problems* and *Practices*; which, when they are deducible from, or founded upon ſome general Propoſition, are called the *Geometrical Effections* thereunto belonging.

EFFERVESCENCE, a Word much uſed by the Modern Philoſophers and Chymiſts; it expreſſes a greater Degree of motion and ſtruggling of the ſmall parts of a Liquor, than we underſtand by the Word *Fermentation*, and implies a great Ebullition or boiling up with ſome Degree of Heat; and is the uſual Term for the Effect of pouring an acid Liquor, (as ſuppoſe *Oil of Vitriol*) on an *Alkaliſate* one, as on *Oil of Tartar per Deliquium*; for a very great Commotion, ſtruggling Heat, and boiling will immediately ariſe, which may be called a great *Effervescence.*

Lemery defines it to be an Ebullition or Boiling of any Liquor without the Separation of its Parts; but that doth not fully expreſs the meaning of the Word.

EFFLUVIUMS, are ſuch very ſmall Particles or Corpuſcles, as are continually flowing out of all mix'd Bodies.

The very great Subtilty and Fineneſs of the Effluvia of many Bodies, appears from their being able for a long time together, to produce ſenſible Effects, without any ſenſible, or at leaſt, conſiderable Diminution of the Bulk or Weight of the Body that emits them.

And that theſe *Effluviums* may conſiderably operate upon, and have great Effect on Bodies within the Sphere of their Activity, Mr. *Boyle* proves from theſe Conſiderations;

1. That the *Number* of the Particles or Corpuſcles emitted as Effluviums out of any Body, is *vaſtly great.*

2. That they are of a very *penetrating* and *pervading* nature, and ſo can moſt eaſily inſinuate themſelves into the Bodies they operate upon.

3. That they are moved with vaſt celerity, and oftentimes with all manner of Directions, and very various Modifications.

4. That there is often a wonderful Congruity or Incongruity of the Bulk and Shape of theſe Effluvia, to the Pores of the Bodies they penetrate into, and act upon.

5. That eſpecially in animal and organical Bodies, theſe Effluvia may excite great Motions of one Part of the curious Engine upon another, and thereby produce very conſiderable Effects in the animal Oeconomy.

6. That they may have ſometimes a Power to make themſelves be aſſiſted in their Operations *by the more Catholick Agents of the Univerſe*; ſuch as Gravity, the preſſure of the Atmoſphere, Light, Magnetiſm, &c.

EGESTION, the ſame with *Digeſtion.*

EJECTIONE *Cuſtodiæ*, is a Writ which lieth properly againſt him that caſteth out the Guardian from any Land during the Minority of the Heir.

EJECTIONE *Firmæ*, is a Writ that lieth for the Leſſee for Term of Years, that is caſt out before his Term is expired, either by the Leſſor or a Stranger.

EIRE, or *Eyre*, in *Britton*, *Cap.* 2. ſignifies the Court of Juſtices *Itinerant.* And Juſtices in *Eyre* are thoſe which *Bracton* in many Places calleth *Juſticiarios itinerantes*, of the *Eyre.* The *Eyre* alſo of the Foreſt, is nothing but the *Juſtice-Seat* otherwiſe called, which is, or ſhould, by ancient Term, be held every three Years by the Juſtices of the Foreſt.

ELABORATORY: See *Laboratory.*

ELASTICITY. The Cauſe of the Elaſticity of Fluids, ſuch as our Air, may eaſily be accounted for, from their Particles being all endowed with a centrifugal Force, like what Sir *Iſaac Newton* mentions in *Prop.* 23. *lib.* 2. of his excellent *Principia.* And to ſolve the ſpringineſs or elaſticity of ſolid and firm Bodies, we muſt have recourſe to another univerſal Law of Nature, *Attraction*; by which the Parts of ſolid and firm Bodies are cauſed to cohere together. When therefore hard Bodies are either *bent* or *ſtruck*, ſo that the component Particles are a little moved from one another, but not quite disjoined and broken off, nor ſeparated ſo far as to be out of the Power of that attracting Force, by which they cohere together; they certainly will, on the ceſſation of the external Violence, ſpring back with a very great Velocity to their former natural ſtate. Suppoſing, as I ſaid before, that the Particles are not ſeparated by the *Flexure*, or the *Shock*, ſo far from one another, as that the Atoms of any foreign Fluid can get in between them, and hinder the attractive Force; for then, as ſoon as ever the ſeparating Force ceaſes, the Attractive will act, and bring them back to their former ſtate.

ELASTICK *Force*, primarily, is the Force of a Spring when bent, and endeavouring to unbend it ſelf again.

In Phyſicks, 'tis taken for the endeavour of Springing or elaſtick Particles, when compreſs'd or crowded into a little room, to dilate and elevate themſelves again: Wherefore by this Name they frequently call ſuch, an Exploſion of Animal Spirits, as is frequent in Cramps or Convulſions, The effect of this Power, or this Quality, in Bodies, is called *Elaſticity*; and Bodies that have it, *Elaſtick Bodies.*

And as a *ſoft Body* is that which when preſs'd yields to the Stroke, and loſes its former Figure, and cannot recover itſelf again; ſo an

Elaſtick Body is that which tho' it yields for a while to the Stroke, yet can afterwards recover its former Figure by its own natural Power; and if it can do this with the ſame Force as that which preſs'd upon it, we ſay it is perfectly *Elaſtical.*

If there was no *Elaſticity*, the Laws of Motion found by Mathematicians, about the Percuſſion of two Bodies, would hold univerſally, and be without Exception true: And the Bodies (as Mr. *Keil* obſerves in his *Introduct. ad veram Phyſicam*, *p.* 151.) would move jointly that way, towards which the ſtronger Body tended before the Shock or Percuſſion, and with a celerity eaſily determinable by thoſe Laws of Motion. But becauſe there are very few Bodies without ſome degree of *Elaſticity*, even ſoft Clay, Wax, *&c.* containing within them ſome Particles of elaſtick Air; from hence it is, that Bodies which ſtrike or move one againſt another, do ſpring or leap back, and move with very different Velocities, ſometimes one way, ſometimes another.

If you imagine a String or Wire to be ſtrained, and faſtned firm at each end, then 'tis plain, that if either the middle Part of the String (or any other) be either drawn by the Hand, or preſs'd by a Weight out of the right Poſition it was firſt in, then if the Force that removed it be not greater than the elaſtick Force of the String, the String will fly back; and if the Weight or Body be not removed, drive it before it, as the String of a Croſs-bow doth the Bullet; and the acquir'd velocity of the String will carry it beyond its firſt right Poſition towards the oppoſite Parts, and that ſo far as till the Motion that way be equal to the elaſticity of the String; and then being quite deſtroyed, the String will return again as before; and thus ſpringing forward and backward, would (abſtractly from the reſiſtance of the Medium) like a double Pendulum, make continual Vibrations. Thus alſo, if you ſuppoſe any Weight to fall on an immoveable fix'd and perfectly elaſtick Body; on the contact, the Parts of the elaſtick Body will ſpring back or recede inwards, till the elaſtick Force be raiſed up equal to the *Momentum* of the falling Body; and then this latter ceaſing, the elaſtick Force will caſt the Body upwards or from it, with the ſame Velocity it came down, or was impelled againſt it, recovering again its former Figure; but if both the Bodies being elaſtick, neither of them be fixed or moveable, then the elaſtick Force will act equally in each Body, and produce equal Mutations of Motion.

And from this *Elaſticity* in Bodies ariſes that *Reſilition* or leaping back from one another, which we obſerve in many Bodies on their moving ſwiftly one againſt another. The uſual Method to judge whether Bodies are endowed with this elaſtick Quality or not, is to enquire whether, on being ſtruck, they give any *Tinnitus*, or ringing Sound, or indeed any ſenſible Noiſe; for if they do, you may conclude them in ſome meaſure elaſtical; and that they are ſo in proportion to the ſtrength and acuteneſs of the Sound they emit.

Mr. *Keil* gives theſe Rules for the Motion of elaſtick Bodies.

THEOREM.

If two Bodies perfectly elaſtick ſtrike one againſt another, there will be or remain in each the ſame relative Velocity as was before; that is, ſuch Bodies will recede from each other with the ſame Velocity that they met together with.

For the compreſſive Force or the Magnitude of the Stroke in any given Bodies, ariſes from the relative Velocity of thoſe Bodies, and is proportional to it: And Bodies perfectly elaſtick, will reſtore themſelves compleatly to the Figure they had before the ſhock: or in other Words, the reſtitutive Force is equal to the compreſſive, and therefore muſt be equal to the Force with which they acceded, and conſequently they muſt by elaſticity recede again from each other with the ſame Velocity. *Q. E. D.*

COROLLARY.

Hence, taking equal times before and after the ſhock, the diſtances between the Bodies will be equal: And therefore the diſtances of the Bodies from the common center of Gravity will, in the ſame times, be equal.

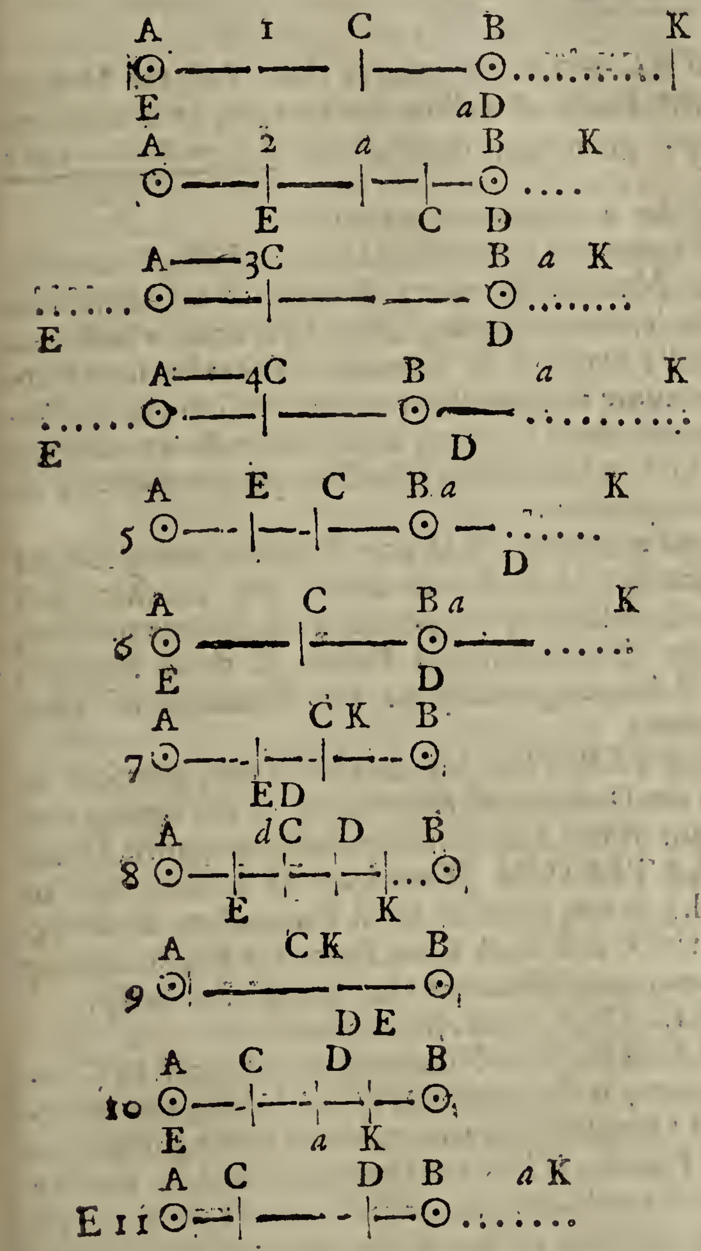
Whence the Laws of the meeting of Bodies perfectly elaſtick are eaſily deduced, which he doth by this Problem.

PROBLEM.

To determine the Rules of the direct meeting or ſhock of Bodies perfectly elaſtical.

One Conſtruction will ſerve for all Caſes of this Problem.

Let there be two Bodies, *A* and *B*, perfectly elaſtical, whoſe common Center of Gravity let be *C*, be C, and let D be the Point of concourſe where the Bodies meet; make CE always equal to CD. Then I ſay, that after the concourſe or ſhock, the right Line CE will expreſs the Velocity of the Body A from E towards A; and the right Line EB will expreſs the Velocity of the Body B, from E towards B.



DEMONSTRATION.

Since the common centre of Gravity of any Bodies, proceeds on with the ſame uniform Progreſſion, and with the ſame Velocity both before and after the Shock and Impulſe, as he proves in *Theorem* 18. and that in a Time equal to that in which the Body A moves the Length AD, or the Centre of Gravity C moves the Length CD; and after the Concourſe the ſame Point C will move the Length $DK =$ to DC. This being ſo, let Ka be taken equal to CA; then, ſince by *Cor.* of the preceding *Theorem*, taking equal Times both before and after the Impulſe, the diſtances of the Bodies from the common centre of Gravity will always be equal; then at what time the common centre of Gravity will be in K, the Body A will be found to be in a; and therefore after the Impulſe, its Motion will be from D towards a, and its velocity will be expreſſed by Da, which is the length run over in that Time. But becauſe $CE = CD$, or to KC and $Ca = Ka$, the difference between the Right Lines CE and CA will be equal to the difference between the Right Lines Kd and Ka; that is, $EA = Da$: But the Right Line Da expreſſes the velocity of the Body A after the Shock or Impulſe, and conſequently its velocity will alſo be expreſſed by the Right Line EA. Beſides, ſince the relative velocity of theſe Bodies remains the ſame both before and after the Shock, and that the Right Line EA denotes the velocity of the Body A, the velocity of the Body B muſt neceſſarily, after the Impulſe, be denoted by the Line EB, and the direction of the Motion will be from E towards B.

COROL. I.

Hence, if the Body B be at reſt, the Points D and B will be co-incident, as in the Caſe of the three firſt Lines in the Figure; and becauſe $B : A :: AB : CB$; therefore, by Compoſition, $B + A : AA :: AB : CB$; and doubling the conſequent Terms of the Proportion, $B + A : 2A :: AB : 2CB$; that is, in Words, *As the Aggregate or Sum of the Bodies : is to the Double of the moving or ſtriking Body :: So will the Velocity of the ſtriking Body be before the Shock : To the Velocity of the quieſcent Body after it.*

COROL. II.

Wherefore if the Bodies A, B, are equal, the Sum or Aggregate of them muſt be $2A$: Whence the velocity of the Body B, after the Shock, ſhall be equal to AB, the velocity of the Body A before it; and conſequently the Point E and A being co-incident, AE the velocity of the moving Body after the Impulſe or Shock, will be $= o$; that is, none at all. Which alſo may be eaſily ſhewn thus; becauſe the Bodies A and B are equal, AC will be $= CB = CD = CE$; wherefore the Point E will co-incide with A, and conſequently the Body A, after the Shock, will be at reſt, and the Body B will move with the velocity EB or AB.

If therefore a perfectly Elaſtick Body ſtrike directly againſt another equal to it, and which is at reſt; after the Shock the moving Body will loſe all its Motion, and the Quieſcent move on with the velocity of the former.

COROL. III.

If the Bodies A and B are equal, and both move the ſame way, as in Line the fourth of the Figure, they will move alſo both the ſame way after the Shock, and with the mutual exchange of their Velocities.

For ſince $CE = CD$, and $AC = CB$; $CE - AC$, that is, EA, muſt be $= CD - CB$, or to BD; and conſequently the velocity of the Body A after the Shock, will be equal to that of B before it. Beſides, ſince $EA = BD$, EB will be $= AD$; and therefore the velocity of the Body B after the Shock, muſt be equal to that of A before it.

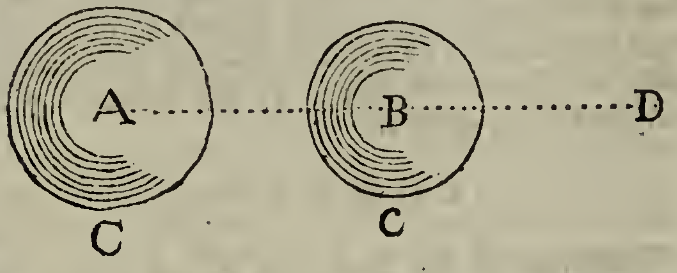
COROL. IV.

If the equal Bodies B and A move with contrary Directions, as in Line the tenth of the Figure, they will alſo, after the Concourſe and Shock, move contrary ways, and with their velocities counterchanged.

For ſince $AC = CB$, and $CE = CD$, $AC - CE$; that is, AE muſt be equal to $CB - CD$, or to BD; and therefore the velocity of the Body A, after the Shock, will be equal to that of B before it. Beſides, ſince $EA = BD$, AD will be $= EB$: But AD expreſſes the velocity of the Body A before the Shock, and EB the velocity of B after it; wherefore the Truth of this *Corollary* is plain.

After this he ſhews a very eaſy Method to bring theſe *Theorems* to Practice, by a Calculation in Numbers.

For ſuppoſe (1) the Bodies A and B both move the ſame way, and that the velocity of the precedent Body B be c, and that of the ſubſequent A be C; wherefore the relative velocity of theſe two Bodies will be $C - c$, and the Sum of their Motions the ſame way $AC + Bc$: Let x denote the velocity of the ſubſequent Body A after the Concourſe and Shock; then becauſe the relative velocity of Bodies before and after the Shock continues the ſame, the velocity of the Body B will be expreſſed by $x + C - c$.



For the relative velocity of Bodies is equal to that by which the velocity of the ſwifter exceeds that of the ſlower; and therefore that Exceſs muſt be expreſſed by $C - c$. Wherefore, ſince the velocity of the ſubſequent Body $A = x$, its Motion towards D muſt be Ax: And ſince the velocity of the preceding Body $B = x + C - c$, its Motion alſo towards D muſt be expreſſed thus, $Bx + BC - Bc$; and the Sum of theſe two Motions will be equal to the Sum of the former Motions: That is, in Species, $Ax + Bx + BC - Bc = AC + Bc$; and by Tranſpoſition, $Ax + Bx = 2Bc - BC + AC$; and then by Diviſion, $x = \frac{2Bc - BC + AC}{A + B}$ = Velocity of the Body A.

And ſo alſo the velocity of the Body B is $= x +$

$$C - c = \frac{AC - BC + 2Bc}{A + B} + C - c = \frac{AC - BC + 2BC + AC + BC - Ac - Bc}{A + B}$$

$$= \frac{2AC - Ac + Bc}{A + B}$$

If BC be greater than $AC + 2Bc$, then x or $\frac{AC - BC + 2Bc}{A + B}$ will be a negative Quantity; and conſequently the velocity of the Body A will have a contrary Direction, and its Motion towards D will be negative.

If the Body B be at reſt, that is, if $c = 0$, then the velocity of the Body A after the Shock will be $\pm \frac{AC - BC}{A + B}$, forwards or backwards according as the Sign + or — prevails.

If the Bodies A and B, with the velocities C and c, move contrary ways, and conſequently meet one another directly; their Motion the ſame way will be expreſſed by $AC - Bc$, and the relative velocity of the Bodies will be $C + c$.

Let then x ſtand for the required velocity of the Body A after the Shock; its Motion that way, which it went before the Shock, will be expreſſed by Ax, and the velocity of the Body B will be $x + C + c$ (for the relative Velocity of Bodies is not altered by the Shock) and then the Motion in the Body B towards D, will be $Bx + BC + Bc$; wherefore the Sum of the Motions the ſame way, will be $Ax + Bx + BC + Bc$ which (by his 14th *Theorem* about the Laws of Motion) will be $= AC - Bc$; ſo that $Ax + Bx = AC - BC - 2Bc$, and $x = \frac{AC - BC - 2Bc}{A + B}$

And the velocity of the Body B will be

$$\frac{AC - BC - 2Bc}{A + B} C + c = \frac{AC - BC - 2Bc + AC + Ac + BC + Bc}{A + B}$$

$$= \frac{2AC + Ac - Bc}{A + B}$$

If $BC + 2Bc$ be greater than AC, the Motion of the Body A will be backwards, or a contrary way; in which Caſe x or $\frac{AC - BC - 2Bc}{A + B}$ will be a negative Quality.

Whatever be the Phyſical Cauſe of *Elaſticity*; Sir *Iſaac Newton*, Prop. 23. Book 2. of his admirable *Princip.* demonſtrates, That "Particles which mutually avoid or fly from one another by ſuch Forces as are reciprocally proportional to the Diſtances of their Centers, will compoſe an elaſtick Fluid, whoſe Denſity ſhall be proportional to its Compreſſion.

And *vice verſa*, "If any Fluid be compoſed of Particles that fly or avoid one another, and hath its Denſity proportional to its Compreſſion, then the centrifugal Forces of thoſe Particles will be reciprocally as the Diſtances of their Centers.

ELATERISTS, Mr. *Boyle*'s Word, are ſuch as hold the Doctrine of *Elaterium*, or the Spring and Weight of the Air, which he defends againſt *Linus*.

ELATERIUM [Ελατήειον of ελαύνω, Gr. to expel,] is the Juice of wild Cucumbers made up in a thick and hard Conſiſtence: Alſo, according to ſome, any Medicine that purges the Belly.

ELECTICA: See *Attrahentia*.

ELECTION, in Numbers, with Regard to Combinations, is the ſeveral Ways of taking any Number of Quantities given, without having reſpect to their Places. Thus the Quantities *a*, *b*, *c*, may be taken ſeven Ways; as *abc*, *ab*, *ac*, *bc*, and *a*, *b*, *c*. See *Schooten* in his *Miſcellanea*; and *Strode* of *Combinations*. See alſo the Word *Combination*.

ELECTION *de Clerk*, is a Writ that lieth for the Choice of a Clerk, aſſigned to take and make Bonds called *Statute-Merchant*; and is granted out of the Chancery upon Suggeſtion made, That the Clerk formerly aſſigned is gone to dwell in another Place, or hath hindrance to lett him from following that Buſineſs, or hath not Land ſufficient to anſwer his Tranſgreſſion if he ſhould deal amiſs.

ELECTRICITY, is the Quality that Amber, Jett, Sealing-Wax, &c. have of attracting all kinds of very light Bodies to them, when the attracting Body is rubbed or chafed. And this is moſt probably the Effect of a *Material Effluvium* (as the Noble Mr. *Boyle* expreſſes it in his Notes on this Quality) iſſuing from, and returning to the electrical Body, and aſſiſted alſo in ſome Caſes by the external Air. For the Solution of this *Phænomenon* there are ſeveral *Hypotheſes*, and all Mechanical.

1. *Cabæus* ſuppoſes, That actual Streams do iſſue out of the electrick Body when agitated by Attrition; and that theſe do diſcuſs and repel the ambient Air, which, after it hath been driven off a little way, makes, as it were, a little Whirlwind from the reſiſtance which it finds in the remoter Air, to which theſe electrick Streams did not reach: And that theſe Streams ſhrinking quickly back again to the attracting Body, do, in their return, attract or bring along with them ſuch light and ſmall Bodies as they meet with in their way.

To which Mr. *Boyle* adds, that the Gravity of the incumbent Atmoſphere ſurmounting the ſpecifick Gravity of the little rarified Atmoſphere of the electrick Body, may probably facilitate the Tendency of the ſmall Particles of Matter towards the attracting Body.

2. Our Famous *Gilbert*, Sir *K. Digby*, *Gaſſendus*, Dr. *Brown*, and many others, ſuppoſe, That on rubbing or chafing, the electrick Body is made to emit Rays or Files of an unctuous Nature, which, when they come to be condenſed and cooled by the ambient Air, do loſe their Agitation, and then ſhrink back again into the Body from whence they ſally'd out; and by that means do carry along with them ſuch light and ſmall Bodies as happen to be faſtened or ſticking to their further Ends. *Gaſſendus* thinks alſo, That theſe unctuous *Effluvia* being emitted all manner of ways, do decuſſate frequently, or croſs one another; and by this means do take the better hold of Straws, &c. into whoſe Pores they inſinuate themſelves.

3. *Des Cartes* being not able to imagine that ſo ſolid a Body as Glaſs was capable of emitting Effluvia; (tho' it is certain that two pieces of Glaſs rubbed one againſt another, will ſend forth an unpleaſing Odour, which muſt conſiſt of material Effluvia) he had recourſe to the Operation of his *Materia Prima* for the Solution of *Electricity*; but he ſpeaks of it doubtingly himſelf, and unintelligibly to the Reader (as it appears to me); therefore I ſhall refer you to the Place itſelf, where, if you think it worth while, you may ſee what he ſaith at large. *Vid. Cartes Princip. Lib.* 4. *Chap.* 184. *p.* 210.

Mr. *Boyle*, in order to prove Electricity to be a Quality which hath, like all others, in natural Bodies, a Mechanical Original, hath given us the following Obſervations and Experiments about this *Effect*; from whence a very good gueſs may be made how *Electrical Attraction* is produc'd, *viz.*

1. That Electrical Bodies do not at all, or at beſt but very rarely *attract*, but when they are *warm'd*, and thereby ſollicited to emit Effluvia more copiouſly.

2. That theſe Bodies warm'd only by the Fire, don't attract ſo forcibly as they will when heated by rubbing; tho' if they are firſt warmed at the Fire, and then rubbed afterwards, they will attract moſt ſpeedily and powerfully. So that Heat ſeems neceſſary in general to put the Parts into agitation; and rubbing or chafing in particular, to give them their moſt proper Modification.

3. *Terſion* (as he calls it) or *Wiping*, is almoſt univerſally neceſſary, as well as Attrition or Rubbing, to produce Electricity; for thereby the Steams or Effluvia can the better get out, when there is nothing to ſtop up, or choak the Pores of the attracting Body.

4. The Magnetical Effluvia will pervade all manner of Bodies freely; yet the interpoſition of the fineſt Linen or Paper will hinder the Operation of all Electrical Particles; which ſeems to confirm their being ſomething of an unctuous Nature.

5. This Effect is very much weaken'd if the Weather be thick and cloudy, and eſpecially if the South Wind blow, as *Kircher* aſſerts from his own Experience. But it always continues ſome time after it is once excited by rubbing and chafing, and doth not ceaſe in an Inſtant.

6. Electrical Bodies attract all Things indifferently, whereas the Magnet draws only Iron and Steel.

7. Our excellent Naturaliſt ſuſpended a fine large Piece of very Electrical Amber by a ſilken Thread, and then had one end of it rubbed ſtrongly on a little Cuſhion, and then he found that when the Amber was made to hang perfectly at reſt, if the Cuſhion was brought near it, tho' not to touch it, it would plainly make the Amber tend towards it and follow it. From whence it plainly appears, that other Bodies can draw or move the Electrick one, as well as *it* the others; and that it is by Accident only, and not from Neceſſity, that the ſmall attracted Bodies go to the Electrick one.

8. By many repeated Experiments he found this Electrical Quality to be producible and deſtructible.

9. He found alſo that a Piece of Amber did ſenſibly attract when the Air was pumped out of the Receiver; which confirms the Hypotheſis of thoſe that ſuppoſe actual Strings or little unctuous Rays to go out of the Electrical Body.

10. He found alſo, that after an Electrical Body had been well rubbed, there was a certain nick of Time in which the light Body would, inſtead of being attracted, be actually driven away from the Electrical Body, by the Effluvia going briſkly out and not yet returning again; which much confirms the Hypotheſis of *Gilbert*, *Digby*, *Brown*, &c. mentioned in *N.* 2.

In *Philoſ. Tranſ. N.* 308, there is an Account of an Experiment made before the Royal Society at *Greſham* College, touching the extraordinary electricity of Glaſs, producible by a ſmart Attrition of it, with ſome odd Phænomena thereon depending: as, That Moiſtneſs will at any time hinder the Electrical Attraction: That the interpoſition of the fineſt Lawn or Muſlin between the Body heated by rubbing, and the light Bodies to be attracted, will deprive it of all electrical Force: That when the electrick Body (which was a Tube of Glaſs 1½ in Diameter, and 30 in Length) became hotteſt by the greateſt Rubbing, it ſent forth Effluvia that might ſenſibly be felt to ſtrike againſt your Face, when the Tube was held near it: That exhauſting the Tube of Air by the Pump, did almoſt totally deprive it of its electrical Force, tho' rubb'd never ſo much, &c. All which Experiments I have often made myſelf, and find to be very truly related there. 'Tis obſervable, that on rubbing the Tube in the Dark, a Light would be produced; which was greater when the Tube was exhauſted of Air, and then ſeem'd to be all within the Tube; and when another Hand, or ones Finger was held near the Tube in the dark, a Light was ſeen to break from it, with a ſnapping Noiſe, like that of a green Leaf in the Fire, but not ſo ſmart and loud.

He got alſo a cylindrical Glaſs, and cauſed it by the contrivance of a Wheel to be briſkly turned round in an horizontal Poſition: When this Glaſs being exhauſted of Air, was turn'd round its Axis, a conſiderable Light would be produced, by the attrition of ones Hand on the outſide; and when the Air was let in, it was ſurpriſing to ſee, that on the application of ones Finger towards the Glaſs, a vigorous Light would be produced, which began at the Finger firſt, and ſeem'd to gravitate on it, and was ſenſibly to be felt there, at half an Inch diſtance from the revolving Glaſs. And this purple Light was viſible, even by Day, or in the Light. Mr. *Hawkſbee* contrived alſo, that ſome looſe Threads ſhould be faſten'd at one end to a Circle of Wire, which was faſten'd at Right Angles to the Axis of the Glaſs, and within it; and then we obſerv'd ſeveral times, that when the Glaſs was ſwiftly moved round, and, by that means, ſtrongly rubbed and heated, all thoſe looſe Threads would ſtand upright, and point directly towards the Axis of the revolving Glaſs.

He afterwards fix'd the lower ends of Threads into a circle of Cork, which was placed at Right Angles to the Axis as before, but the upper ends of the Threads hang looſe; but as ſoon as the Glaſs was turn'd round as before, rubbed and warmed, the Threads would ſtand up an end in the ſame Plane with the Circle they were faſtened to; and would point directly from the Axis towards the inward ſurface of the Glaſs; unleſs when moved by the application of ones Finger without; which would, ſurpriſingly, make them bend and point towards it.

ELECTUARY, is a Medicine of a Conſiſtence, thicker than a Syrup or Linctus, and compoſed of hard things reduced to Powder, and accurately mixed with Syrups, Conſerves, Honey, *&c.*

ELEGIT, is a Writ Judicial, that lieth for him that hath recover'd Debt or Damages in the King's Court againſt one not able in his Goods to ſatisfy, and directed to the Sheriff, commanding him that he make Delivery of half the Parties Lands or Tenements, and all his Goods, Oxen and Beaſts of the Plow excepted.

ELEMENTS, is a Word uſed by Natural Philoſophers, in the ſame Senſe uſually as *Principles*; and by the Elements and Principles, or as they ſometimes call them *the Elementary Principles* of a Natural or Mixed Body, they mean thoſe ſimple Particles out of which the Mixed is compoſed, and into which 'tis ultimately reſolvable.

The Word comes from *L*, *M*, *N*, three of the Letters of the Alphabet; and is alſo frequently uſed for the firſt Principles or Rudiments of any Science. Thus the Propoſitions of *Euclid* are called his *Elements*, becauſe they contain the firſt Principle of Geometry.

ELEPHANTIASIS *Arabum*, of which the *Greeks* ſpeak nothing, but the *Arabians* do frequently, is a-kin to a *Varix* or crooked Swelling in the Veins, and proceeds from thence, and is only a Tumor in the Feet. *Avicenna* treats of this Diſtemper, where he ſpeaks of the *Varices*; yet *Rhaſes* differs from him, and *Haly Abbas* follows the *Greeks*, who ſay, That an *Elephas* is a Diſeaſe which corrupts all the Members of the Body, and is, as it were, an *univerſal Cancer.* But neither is he conſiſtent with himſelf, when he writes, that *Ulcers* in the Legs and Feet are called *Elephas*; and that *Elephanticus Morbus* is an Impoſtume proceeding from Melancholy, in the Legs and Feet; and the Sign of it is, That the Shape of the Foot is like the Figure of an Elephant. All the reſt treat ſeparately of a *Leproſy* and an *Elephantia*, and make the latter to be a Swelling of the Feet, proceeding from Melancholy and pituitous Blood, and the crooked Swelling of the Veins, whereby the Feet reſemble the Feet of an Elephant in Shape and Thickneſs: And this ſort of Tumor is often ſeen in Beggars who wander much. *Blanchard.*

ELEPHANTIASIS *Græcorum*, which the *Arabians* call a Leproſy: It is called alſo *Elephas*, *Elephantiaſis*, and *Elephantia*, from an Elephant, as ſome think, becauſe it makes People big like an Elephant, which is a fooliſh notation of the Word; for the Body is no bigger, tho' the Diſeaſe be. Others think 'tis ſo called, becauſe the Diſtemper lying in the Legs, make them ſtiff and equal like an Elephant; or becauſe it is a ſtrong vehement Diſeaſe like an Elephant, with ſuch like Stuff. *Galen*, in his 14th Chapter of Tumors, ſays, that "This Diſeaſe is called a *Satyriaſmus* when firſt it "begins, becauſe it makes the Face like that of a "Satyr; for the Lips are thick, the Noſe ſwells, "the Ears decay, the Jaws are red, the Forehead "is ſet with Tumors, like ſo many Horns." Tho' others think it is called *Satyriaſmus*, becauſe the Perſons afflicted are much inclined to Leachery at the beginning, as Satyrs are. *Celſus* deſcribes it thus: "The whole Body (ſays he) is ſo affected, "that the very Bones may be ſaid to be corrupted. "The upper Parts of the Body are full of Spots "and Tumors, the Redneſs whereof is gradually "turned into Black: The top of the Skin is unequally thick, thin, hard, ſoft, rough, as if it had "Scales on it; the Body decays, the Bones, Calves "of the Legs, and Feet, ſwell. When the Diſeaſe "is old and inveterate, the Toes and Fingers are "hid in the Swelling, and a ſmall Fever ariſes, "which eaſily conſumes a Man loaden with ſo "many Infirmities. *Blanchard.*

ELEVATION *of a Mortar-Piece or Gun*, is the Angle which the Chaſe of the Piece, or the Axis of the hollow Cylinder, makes with the Plane of the Horizon.

ELEVATION *of the Pole*, is the Height or Number of Degrees that the Pole, in any Latitude, is raiſed or appears above the Horizon.

ELEVATION *of the Pole*, in Dialling, is the Angle which the Style makes with the Subſtylar Line.

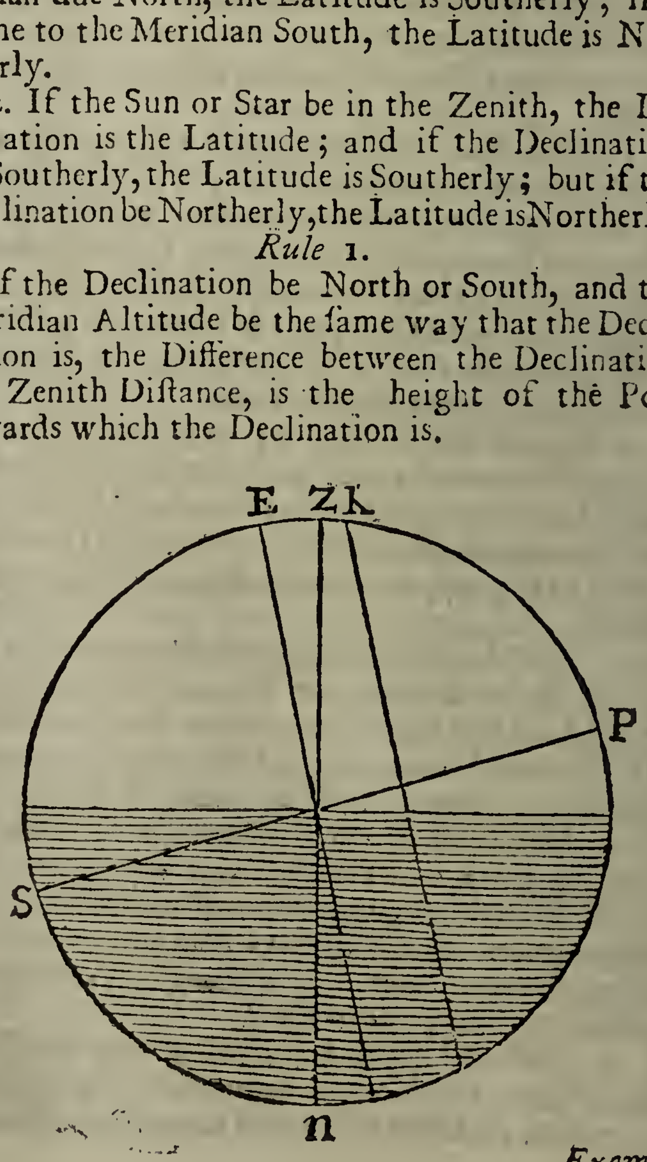
To find the Elevation or Height of the Pole, having given the Declination and Meridian Altitude or Zenith Diſtance of the Sun or Star.

Note, 1. If the Sun or Star have no Declination, the Zenith Diſtance is the Latitude or Height of the Pole; and if the Sun or Star come to the Meridian due North, the Latitude is Southerly; if it come to the Meridian South, the Latitude is Northerly.

2. If the Sun or Star be in the Zenith, the Declination is the Latitude; and if the Declination be Southerly, the Latitude is Southerly; but if the Declination be Northerly, the Latitude is Northerly.

Rule 1.

If the Declination be North or South, and the Meridian Altitude be the ſame way that the Declination is, the Difference between the Declination and Zenith Diſtance, is the height of the Pole towards which the Declination is.

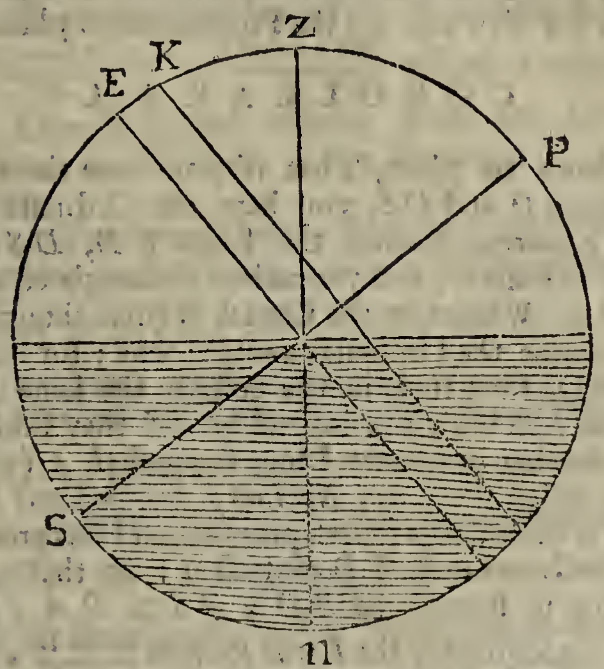


Example 1.

Declination North, ——— 23°. 30′. *E K.*
Zenith Diſtance North, — 8 . 30. *Z K*
Latitude North, ——— 15 . 00. *E Z.*

But if the Declination be leſs than the Zenith-Diſtance, then the contrary Pole to the Declination is elevated: as,

Zenith Diſtance South, 48°. 30′. *Z K.*
Declination South, ——— 20 . 00. *E K.*
Latitude South, ——— 28 . 30. *E Z.*

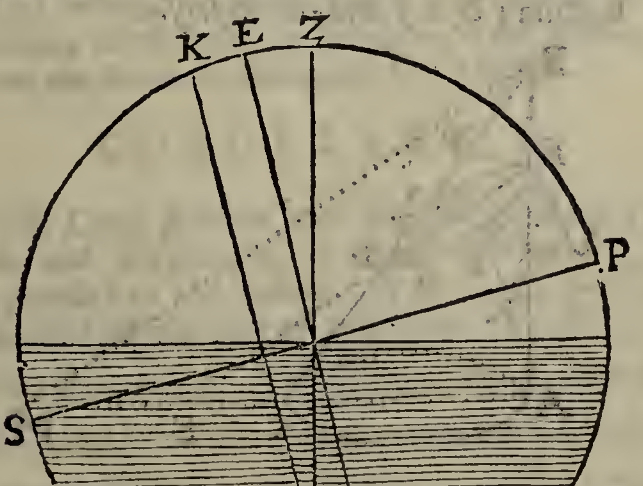


Example 2.

Zenith Diſtance North, 50°. 00′.
Declination North, ——— 15 . 00.
Latitude South, ——— 35 . 00.

Rule 1.

If the Sun or Star's Declination be North or South, and the Zenith Diſtance be contrary to the Declination, the Sum of the Co-altitude and Declination is the *Heighth of that Pole* that the Declination is towards.



Example.

Zenith Diſtance South, 31°. 30′. *Z K.*
Declination North, — 20 . 00. *E K.*
Latitude North, ——— 51 . 30. *Z E.*

Note, If the Declination be the ſame way that the Meridian Altitude is, and greater than the Meridian Altitude, then the Sun or Star may have two Meridian Altitudes in 24 Hours, *viz.* the one above the Pole, and the other below.

In ſuch Caſe the Sum of the Co-declination and Altitude, is the *Heighth of the Pole* towards which the Declination is.

Example.

Declinat. North 21°. 30′. its Compl. 68°. 30′.
Meridian Altitude North, ——— 10 . 30.
Elevation of the North Pole, ——— 79 . 00.

But if the Meridian Altitude be greater than the Declination, then the Difference between the Zenith Diſtance and Co-declination, is the *Heighth of the Pole* towards which the Declination is.

Example.

Declination North, 22°. 30′.
Zenith Diſtance, — 10 . 30. North.
Latitude North, — 12 . 00.

Note, Which way ſoever the Meridian Altitude be, if the Meridian Altitude and twice the Co-declination be leſs than 180 Degrees, the Sun or Star hath two Meridian Altitudes in 24 Hours, and the Latitude is found by the 2d *Rule*.

Example.

Meridian Altitude South, ——— 77°. 00′.
Declin. 62°. 00′. North Compl. 28 . 00.
Sum, 133 . 00.

Which is leſs than 180°. 00′. Therefore,

Zenith Diſtance South, 13°. 00′.
Declination North, — 62 . 00.
Latitude North, ——— 75 . 00.

ELEVATOR, the ſame with *Elevatorium.*

ELEVATOR *Labii inferioris*, is a Muſcle which, with its Partner, lies within the lower Lip. They ariſe fleſhy from the inferior Part of the Gums of the lower Jaw which belong to the *Dentes Inciſorios*, and deſcend directly to their Implantations in the Inferior Part of the Skin of the Chin. Hence it is, when theſe act, they make divers Indentations in the Chin, as may be obſerved in living Perſons, when the lower Lip is drawn upwards. *L.*

ELEVATOR *Labii Superioris*, is a Muſcle which ariſes fleſhy from the fore-part of the *Os Quartum* of the upper Jaw, immediately above the *Elevator Labiorum*, and deſcends obliquely under the Skin of the upper Lip, joining with its Partner in a middle Line from the *Septum Narium*, to its Termination in the *Sphincter Labiorum.* Its Name ſhews its uſe. *L.*

ELEVATOR *Labiorum*, is a Muſcle which lies between the *Zugomaticus* and the *Elevator Labii Superioris Proprius.* It ariſes from the *Os Quartum* of the upper Jaw, and deſcends to its Inſertion under the Termination of the . . . Its Name ſhews its uſe. *L.*

ELEVATOR *Oculi*, is a Muſcle of the Eye, called *Superbus*, from its moral Signification, it being one of the common Marks of a haughty Diſpoſition to look high; wherefore its oppoſite Muſcle is called *Humilis.* This Muſcle ariſes ſharp and fleſhy near the Place where the *Optick Nerve* enters the *Orbit*; and becoming a fleſhy Belly, makes a thin Tendon inſerted to the *Tunica Sclerotis* on the ſuperior and fore-part of the Bulb of the Eye under the *Adnata.* *L.*

ELEVATORES, or *Elevating Muſcles*, are thoſe that ſerve to draw the Parts of the Body upwards. *L.*

ELICIT } [in *Ethicks*] a Term apply'd to
ELICITE } an act of the Will, immediately produc'd by and of the Will, and receiv'd within the ſame.

ELEVATORIUM, ſo called from the lifting up, is a Chirurgeon's Inſtrument, wherewith Pieces of Sculls that are depreſſed are raiſed up again. *L.*

ELIXATION, is the boiling of any thing for a Medicinal Uſe in a proper Liquor, in order that the thing may impart its Vertue to the Liquor 'tis boiled in.

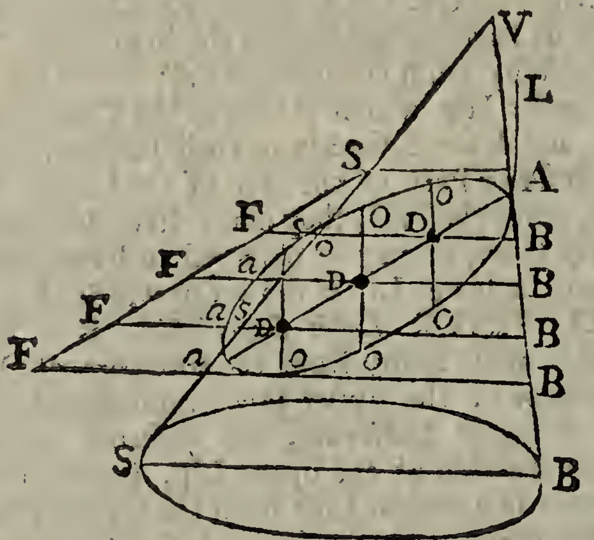
ELIXIR, the Chymiſt's Name for a very fine and uſeful Tincture; as, *Elixir Proprietatis*, *Salutis*, *&c.*

ELIXIR *Proprietatis*, is a Tincture of Myrrh, Aloes, and Saffron, drawn by Spirit of Wine and Spirit of Sulphur. This is *Paracelſus*'s Way, and is really the beſt of any, tho' many others are preſcribed. *L.*

ELLIPSIS, ['Ελλείψις of ἐλλείπω, Gr.] in Grammar, is that Figure whereby ſome Part of our Diſcourſe is left out or retrenched: As in the Latin Expreſſion *Paucis te volo*, in which Words *verbis aloqui* are left out. This Figure is very common in the Oriental Languages.

ELLIPSIS, in Geometry, is an oval Figure; 'tis produced from the Section of a Cone by a Plane cutting both ſides of the Cone (but not parallel to the Baſe, for then it produces a Circle) and meeting with the Baſe produced, as *FDKEO* in the ſecond Figure following.

But firſt I will give you Dr. *Wallis*'s General and Geometrical Way of demonſtrating the General Property of the *Ellipſe*, and which he expreſſes thus.



PROP. I.

In the Ellipſe *the Squares of the Ordinates are equal to the Differences between two Rectangles, of which the Greater are as the Abſciſſæ; the Leſſer as the Squares of the Abſciſſæ.* For,

1. The Squares of DO are $=$ Rectangles $BD \times DS$ every where, becauſe SB is the Diameter of a Circle.

2. Drawing then SF parallel to Aa, the *Latus Tranſverſum*, and producing the BS's every where to F, the Lines DS will every where be $= DF - FS$, where the DF's are all equal, becauſe SF parallel Aa.

3. You will find alſo, That the Rectangles under BD and DS $(= DOq)$ will be $=$ to the Rectangle under BD and DF, deducting that under BD and FS: that is, $BD \times DS = BD + DF - BD \times FS$.

4. Alſo becauſe the DF's are all equal, the Rectangle BDF will ſtill be as the BD's; and thoſe BD's, becauſe of the ſimilar Triangles ADB, will ſtill be as the DA's, or the Abſciſſæ. Wherefore the Rectangles BDF will every where be as the Abſciſſæ AO; which is the Proof of the firſt Part.

5. But the Squares $BD \times FS$, ſince both the BD's and FS's are every where as the AD's, muſt be in a duplicate Ratio of, or as the Squares of the Abſciſſæ AD.

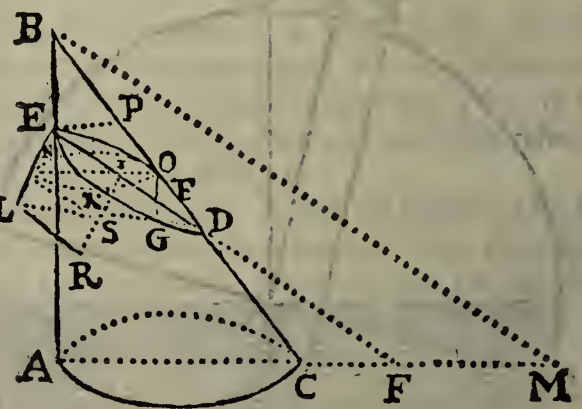
6. Wherefore, ſince the Square of the Ordinate DO $(= DB \times DS)$ is equal to $BD \times DF - BD \times FS$ (*Prop.* 3.) the Propoſition is plain.

COROLLARY I.

Hence 'tis plain, That if you have the Right Lines BD and DS, you have the Ordinate DO but *e contra*, becauſe the Lines BD, DS may vary infinitely, and yet make a Rectangle equal to DOq. Wherefore the Conick Writers thought to determine the Ordinates another way; for inſtead of BD, they took in the Section the Line AD, or the Abſciſſa; and inſtead of AS they ſubſtituted another imaginary Line, ſuppoſe LA (which they called the *Latus Rectum*) and ordered it ſo, that it ſhould be a fourth proportional reciprocally to the Lines AS, BD and DA: So that every where it ſhould be $BD \times AS = DA \times LA$, and conſequently the *Latus Rectum* $= \frac{BD}{AD} \times AS$, and $AS = \frac{DA}{BD}, \times LA$.

PROP. II.

The Square of any Ordinate (IK) in the Ellipſis, *is equal to the Rectangle (IL) under the* Latus Rectum *(EL) and the Abſciſſa (EI) leſs, or abating out of it another Rectangle made by the ſame Abſciſſa (ED) and a foureh Proportional (RS) to the* Latus Tranſverſum, *the* Latus Rectum *(DE) and the Abſciſſa.*



Draw a Parallel to the Section, as MB, which note with b, and continue the Axis of the Section till it meet with the Diameter of the Baſe of the Cone produced in the Point F, and draw it on to M, and call AM, c.

Draw alſo the *Latus Primarium* EP, and parallel to it NO through any given Point, I: Call the Side of the Cone, in which the upper Vertex of the Section is, a. Let the Abſciſſa EI be noted with eb; and then (working by the ſimilar Triangles BCA, and EIN) according to the Rule of Proportions, NI will be expreſſed in this Notation by ec. Let the produced part of the Baſe MC be called d; and the *Latus Tranſverſum*, or Tranſverſe Diameter ED, be called ob: Then will ID be $= ob - eb$.

Since the Triangles BMC, DEP, and DEO are all Similar, work for a fourth proportional to expreſs EP, and you will find it to be od; and IO in this Notation (by the ſame way of working) will be $od - ed$.

Here alſo, as in the Parabola and Hyperbola, the Square $IK =$ Right-angle NIO, which you will find in the *Ellipſis*, muſt be noted by $oecd - eecd$; as in the Hyperbola (you may ſee) 'tis $oecd + eecd$.

If therefore you divide $oecd - eecd =$ the Square of the Ordinate IK, by EI the Abſciſſa in this Notation $= eb$, it will ſtand thus, $\frac{oecd - eecd}{eb}$, or $\frac{ocd - ecd}{b}$, which is equal to the Line IS, and which, with the Abſciſſa $EI = eb$, will make ES a Rectangle $=$ to IK Square.

And if you work here to find the *Latus Rectum*, according to the Canon given in the Parabola, by ſaying, as $b : c :: od : \frac{odc}{b}$, you will have $\frac{odc}{b}$ for the *Latus Rectum*, which you ſee is plainly one Part of the Line IS; and the other, *viz.* $\frac{ecd}{b}$, is a fourth Proportional to b, c, and ed; that is, in *Apollonius*'s way, to ob the *Latus Tranſverſum*, $\frac{ocd}{b}$ the *Latus Rectum*, and eb the Abſciſſa, (for the ſame Quantity $\frac{ecd}{b}$ comes out both ways.) Wherefore the Square of the *Applicate* KI, is equal to the Remainder of the Rectangle IL, contained under the *Latus Rectum* and Abſciſſa; when out of that Rectangle another is taken, which is made by the ſame Abſciſſa, and a fourth Proportional RS to the *Latus Tranſverſum*, *Latus Rectum*, and the Abſciſſa. *Q. E. D.*

COROLLARIES.

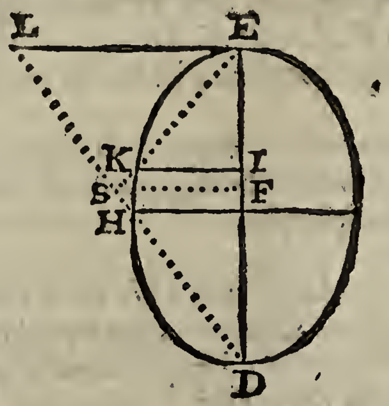
1. Hence the Reaſon of the Name *Ellipſis* given to this Section is evident, becauſe the Square of the Ordinate is leſs than, or defective of the Rectangle under the *Latus Rectum*, and the Abſciſſa.

COROLLARY II.

The *Latus Rectum* here, as well as in the Parabola and Hyperbola, is found by making, As b, parallel to the Section : Is to c, the produced Diameter of the Baſe of the Cone : : So is od, the *Latus Primarium* : To $\frac{ocd}{b}$ the *Latus Rectum* E.L. And here, if the Quantity above and below the Line be multiplied by b, you will have $\frac{ocdb}{bb}$, a Quantity equal to the Former, but more agreeable to *Apollonius*'s way of Expreſſion, who gives this Canon for the *Latus Rectum*, As $bb =$ the Square of the Parallel to the Section : Is to $cd =$ to a Right-angle under the whole Baſe and the Part produced : : So is $ob =$ *Latus Tranſverſum* : To $\frac{ocdb}{bb}$ (or $\frac{ocd}{b}$) the *Latus Rectum*.

COROLLARY III.

Which *Latus Rectum* may be had Geometrically thus;



Having the Ordinate KI, and the Abſciſſa EI, find a third Proportional (FH) to EI and KI ($= EF$;) and then find a fourth Proportional to ID, (the Difference between the *Latus Tranſverſum*, and the Abſciſſa) to the third Proportional FH, before found, and to the *Latus Tranſverſum*; and then that fourth Proportional ſhall be the *Latus Rectum* ſought, LE.

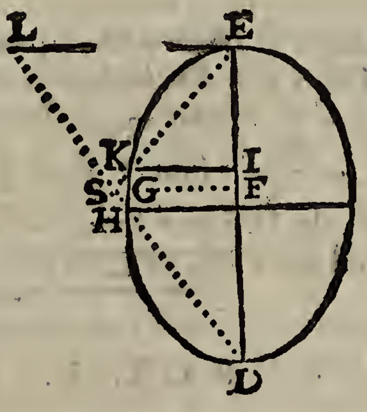
COROLLARY IV.

Hence may as many Points as you pleaſe, be found to draw an *Ellipſis*, whoſe *Latus Rectum* and *Tranſverſum* are given, by giving Ordinates, and applying them to the Axis; Thus,

Take any Abſciſſa, as EI, and then make, As $DE : EL :: $ So $DI : IS$. Then find a mean Proportional between this Fourth, IS and EI, which will be IK, the Ordinate ſought, whoſe End K, when rightly applied, will always be in the Curve of the *Ellipſis*.

PROP. III.

In the Ellipſis *the Square of the Ordinates, KI, GF, are as the Rectangles DIE and DFE, made by the Lines lying between the Ordinates, and the Vertices of the* Latus Tranſverſum.



Let EF be here called ib, as EI was before called eb; then it will be plain from what hath been ſaid in the precedent Propoſition, That the Square GF, the Ordinate will be in this Notation $oicd - eicd$. Alſo the Rectangle DFE will by multiplying DF ($= ob - ib$) by FE ($= ib$) be found to be $oibb - iibb$.

Now ſince by *Prop.* I. the Square $KI = oecd - eecd$, and here we have found the Square $GF = oicd - eicd$; it muſt needs be that the Square KI : Square $GF :: oecd - eecd : oicd - eicd$; that is, (dividing all by cd) as $oe - ce$, is to $oi - ii$.

But the Rectangle $DIE : DFE :: ee - ee : oi - ii$ (for by bare Multiplication the Rectangle DIE will be found equal to $oebb - eebb$, and DFE was above found to be $= oibb - iibb$) which two Quantities divided by bb, will leave $oe - ee$, and $oi - ii$;) wherefore the

Square KI : Square GF : : Rectangle DIE : Rectangle DFE. *Q. E. D.*

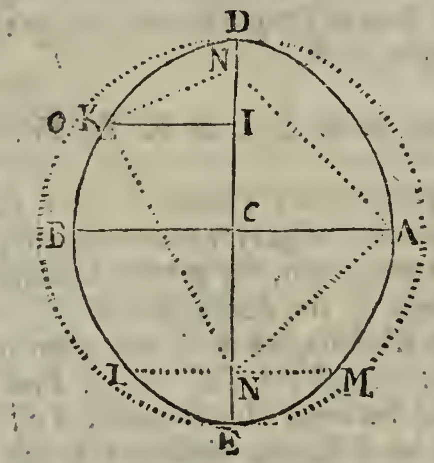
Which Propoſition may be better expreſs'd thus:

In an Ellipſis *the Squares of the Ordinates are as the Rectangles under the Segments of the Diameter, or Axis Tranſverſus.*

Which is certainly true alſo in a *Circle*, where the Squares of the Ordinates are equal to ſuch Rectangles, as being mean Proportionals between the Segments of the Diameter.

COROLLARY I.

In any *Ellipſis*, draw an Ordinate as IK, and ſuppoſe the Focus to be in N, and the *Latus Rectum* LM applied in N at Right-angles to the Axis.



Then will the Square of $\frac{ocd}{2b}$ ($= \frac{1}{2}$ the *Latus Rectum*) $=$ Square of LN be $= \frac{ooccdd}{4bb}$. Wherefore by this Propoſition, As Square IK : Square LN : : Rectangle DIE : Rectangle DNE; that is, $oocd - eecd : \frac{ooccdd}{4bb} : : oebb - eebb : \frac{oocd}{4}$. Wherefore the Rectangle DNE; $= \frac{oocd}{4}$.

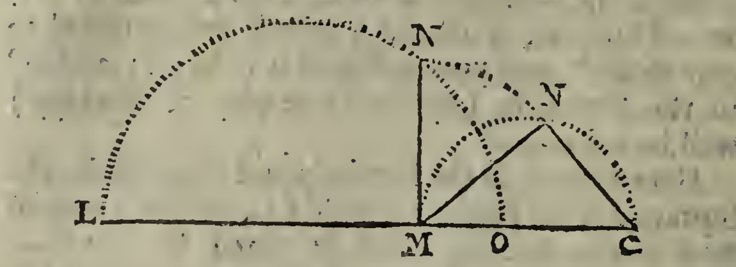
Now Rectangle $DNE +$ the Square of $CN =$ Square CE (by 5 *e.* 2. *Euclid.*) and conſequently CN Square $= CE$ Square $-$ Rectangle DNE: that is, $\frac{oobb}{4} - \frac{oocd}{4}$ (for $CE = \frac{1}{2} ob$.) And therefore CN, the Diſtance from the Centre to the Focus, is equal to $\sqrt{:\frac{oobb - oocd}{4}}$.

COROL. II.

And from hence will ariſe this Canon for determining the Foci of an *Ellipſis* from the Square of half the *Latus Tranſverſum*; Subſtract the fourth Part of the Figure (or $\frac{1}{4}$ of the Rectangle under the *Latus Rectum* and *Tranſverſum*) and then extract the Square Root of the Remainder: That ſhall be the Diſtance of the Focus from the Center, and then ſubſtract that from half the *Latus Tranſverſum*, and it gives EN the Diſtance of the Focus from the Vertex.

COROL. III.

Which Rule is very eaſy in Practice, for $\frac{oobb}{4}$ is only the Square of CE (half the *Latus Tranſverſum*) and $\frac{oocd}{4}$ nothing but the Rectangle of $\frac{1}{4}$ DE into LM the *Latus Rectum* (for $\frac{ob}{4} \times \frac{ocd}{b} = \frac{oocd}{4}$.



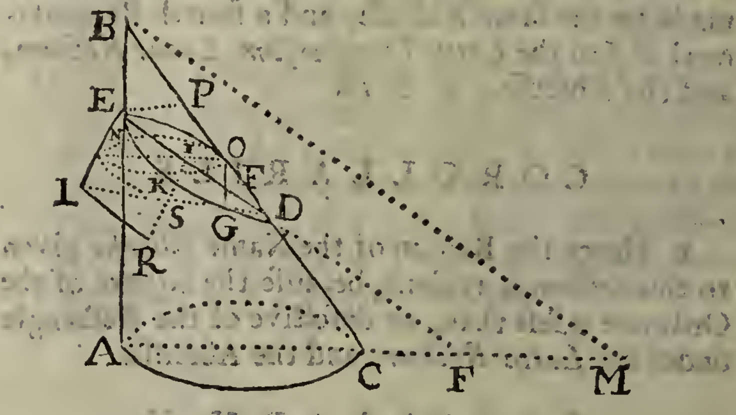
Wherefore find MN a mean Proportional between LM and $MO = \frac{1}{4} DE$;) then on CM ($= CE$) deſcribe a Semicircle, and in it apply MN, and then draw CN, which ſhall be the Diſtance of the Focus from the Center.

COROL. IV.

Since in *Cor.* I. 'twas proved, that the Rectanangle $DNE + CN$ Square $= CE$ Square; that is, Rectangle $DNE = CE$ Square $- CN$ Square. Call CN Square, mm; and then will the Rectangle $DNE =$ (CE Square) $\frac{oobb}{4} - mm$: Which Notation, as one of the ſame Nature in the Hyperbola, will be of uſe hereafter.

PROP. IV.

In the Ellipſis, *The* Latus Rectum : *Is to the* Latus Tranſverſum : : *As the Square of any Ordinate,* IK: *Is to the Rectangle* DIE, *made by the Lines intercepted between it and the Vertices of the* Latus Rectum.



For the *Latus Rectum* is $\frac{ocd}{b}$, and the *Latus Tranſverſum* ob; the Square of the Ordinate $oecd - eecd$, and the Rectangle DIE is $eobb - eeb$, IK is b, as hath been ſhewn in the former Propoſitions: Place therefore theſe four Quantities in the Form of Proportionals, *viz.*

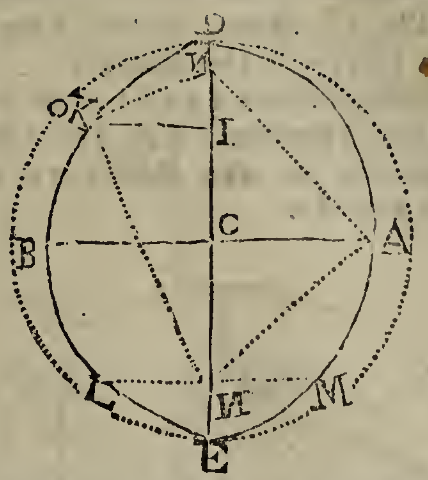
As $\frac{ocd}{b} : ob : : oecd - eecd : oebb - eebb$.

And multiplying the Extreams and Means, you will find the ſame Quantity $ooebcd - oeebcd$ produced both ways, which ſhews they are truly proportional. *Q. E. D.*

COROL. I.

Wherefore if the *Latus Rectum* and the *Axis Tranſverſus* be given in the *Ellipſis*, 'tis eaſy to find the ſecond Axe, by making, As $ob : \frac{ocd}{b} : : \frac{oobb}{4}$, ($=$ Rectangle DCE) : To $\frac{oocd}{4} =$ Square AC.) Wherefore AC is known, and conſequently its Double AB.

Whoſe



Whoſe Square muſt be $oocd =$ Rectangle of the *Latus Rectum* into the *Tranſverſum*, *i.e.* the Figure, as *Apollonius* calls it. Wherefore the *Axis Secundus*, and any Second Diameter, is a mean Proportional between the *Latus Rectum* and *Tranſverſum*; or, to ſpeak with *Apollonius*, is *equal in Power to the Figure*.

COROL. II.

Since the Square of $AC = \frac{oocd}{4}$, and the Squ. of CN (the Diſtance of the Focus from the Center) $= \frac{oobb - oocd}{4}$, by *Corol.* I. of *Prop.* II. Put them into one Sum, and they will make $\frac{oobb}{4}$, which therefore muſt be equal to Square AN, and conſequently the Line $AN = \frac{ob}{2}$; *i. e.* to half the *Latus Tranſverſum.*

Wherefore if you have the Axis in an *Ellipſis*, 'tis eaſy to find the Foci; for you need only *open the Compaſſes to the diſtance* DC, *and ſetting one Foot in* A, *croſs the Tranſverſe Diameter in the Points* N *and* N.

COROL. III.

Since by *Corol.* I. *Prop.* II. the Rectangle DNE was proved equal to $\frac{oocd}{4}$ which, by *Cor.* preceding, $= ACq$, 'tis plain Rectangle $DNE = AC$ Square.

COROL. IV.

The Square of CE ($=$ half the Tranſverſe Diameter): Is to the Square of AC half the Diameter *ſecunda* :: As *Latus Tranſverſum* : to *Latus Rectum*. For $\frac{oobb}{4} : \frac{oocd}{4} :: oobb : oocd :: obb : ocd :: \frac{obb}{b} : \frac{ocd}{b} :: ob : \frac{ocd}{b}$; *i. e. Latus Tranſverſum*, *Latus Rectum*.

COROL. V.

Alſo ſince CE Square : AC Square :: $ob : \frac{ocd}{b}$; that is, by this *Prop.* As Rectangle DIE: Square IK. Therefore Square CE : Square AC :: Rectangle DIE : Square IK; that is alſo (by *Cor.* 3.) As Square CE : Rectangle DNE :: Rectangle DIE : Square IK.

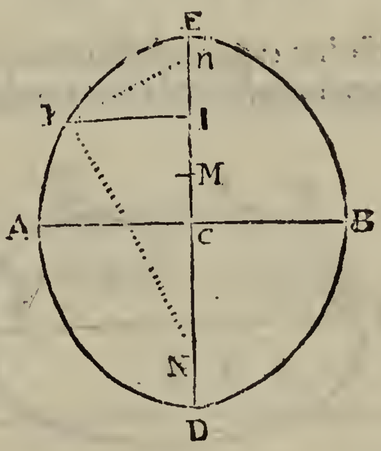
COROL. VI.

Wherefore there will be found a new and uſeful Way of expreſſing the Square of the Ordinate IK (which we found above in *Prop.* I. was $oocd - eecd$) if you make, As CE Square $\left(= \frac{oobb}{4}\right)$: Rectangle $DNE = \left(\frac{oobb}{4} - mm\right.$, by *Corol.* IV *Prop.* II.) :: So Rectangle DIE: To a fourth Proportional; which working Algebraically by the *Rule of Three*, will be found to be $oebb - eebb - \frac{4emm}{o} \times \frac{4mmee}{oo}$

The Advantage of which Notation will ſufficiently appear in the next Propoſition.

PROP. V.

In the Ellipſis, *the Aggregate or Sum of the Right Lines K N and K n, drawn from the ſame Point K, in the Curve of the* Ellipſis, *to both the Foci N and n, is always equal to the Tranſverſe Diameter or Axis D E.*



The Proof of which depends on the Conſideration of the Rectangled Triangles IKN and IKn, where the Sides being given, the Hypothenuſes are eaſily had.

For if (as in *Cor.* IV. *Prop.* II.) you call $CN = m$, then will m be $\frac{\sqrt{:oobb - oocd}}{4}$, and $IN = CI + CN = \frac{1}{2}ob - eb + m$; but In will be $= Cn - CI = m - \frac{1}{2}ob + eb$.

Wherefote the Square of $IN = \frac{1}{4}oobb - oebb + eebb + obm - 2ebm + mm$; and the Squ. of $In = \frac{1}{4}oobb - oebb + eebb - obm + 2ebm + mm$.

Now if to each of theſe Squares you add the Square of IK, (which by *Cor.* VI. of the precedent) was $oebb - eebb - \frac{4emm}{o} + \frac{4mmee}{oo}$, the Sum will be KN Square (or the Square of the Hypothenuſe) which is $= \frac{1}{4}oobb + obm + 2ebm + mm - \frac{4emm}{o} + \frac{4eemm}{oo}$.

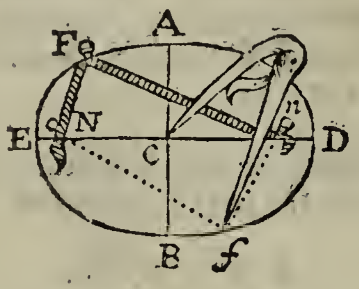
And Square $Kn = \frac{1}{4}oobb - obm + 2ebm + mm - \frac{4emm}{o} \times \frac{eemm}{oo}$.

And conſequently extracting the Roots of thoſe Equations (which is very eaſy) you will have $KN = \frac{1}{2}ob + m - \frac{2em}{o}$, and $Kn = \frac{1}{2}ob - m + \frac{2em}{o}$.

Which two added together, are manifeſtly equal to ob the Tranſverſe Diameter. *Q. E. D.*

COROLLARY I.

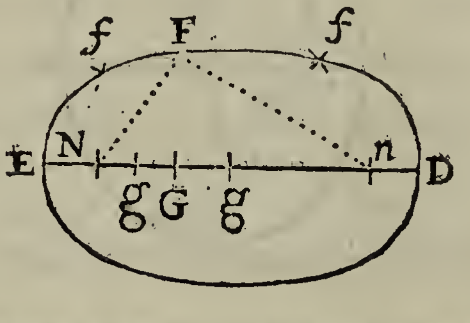
From whence ariſes the Reaſon of the *Ordinary Way* uſed by *Gardeners*, *&c.* to deſcribe *Ovals* or *Ellipſis*'s by two Pins in the *Tranverſe Diameter* at *N* and *n*, and a String mov'd about them by another Pin,



as *F*; for by this Means the Point *F* will always be in the *Ellipſis*; and ſince a Circle is deſcribed by a String moving round one Pin placed in the Center, 'tis plain a Circle is an *Ellipſis*, whoſe Foci are coincident.

COROL. II.

Hence alſo 'tis eaſy to deſcribe an *Ellipſis* on a Plane *Geometrically*, by only *Scale* and *Compaſs*: For



having drawn the *Axis Tranſverſus DE*, and in it taken the Foci *n* and *N*; at a diſtance not more than half the Tranſverſe Axis, with the Compaſſes in *N* ſtrike an Ark, as *f*, and ſet the ſame Diſtance from *E* to *G*.

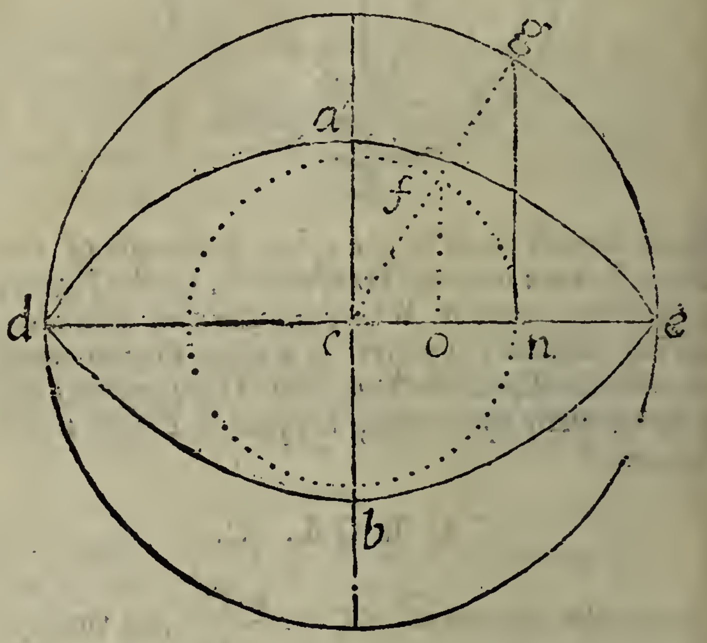
Then opening the Compaſſes to the remaining Diſtance *G D*, with one Foot in *n* croſs the Ark *f*, and that Point will be in the *Ellipſis*: And thus you may find as many Points as you pleaſe with all readineſs imaginable.

ELLIPTICAL *Compaſſes* is an Inſtrument made in Braſs, to draw at one Revolution of the Index any Ellipſis or Oval.

ELLIPTICAL *Dial* is an Inſtrument made commonly of Braſs, with a Joint to fold together, and the Gnomons to fall flat, commodiouſly contrived to take little room in the Pocket. By it may be found the true Meridian, Hour of the Day, Riſing and Setting of the Sun, with ſeveral other Propoſitions of the Globe.

ELLIPTICAL *Space*, is the Area contained within the Curve of the *Ellipſis*.

The *Elliptical Space* $daeb$: is to a Circle deſcribed on the Tranſverſe Axe de : : as the Conjugate Diameter, or *Axis Rectus* ab : is to the Tranſverſe Axe de.



Draw fo, gn perpendicular to Ce.

Then will $fo : fC :: gn : gC$.
And therefore $fo : gn :: fC : gC$.
$:: aC : cC$.
$:: ab : de$.

But this Proportion of $fo : gn :: ab : de$ will be true, wherever the Perpendiculars fo and gn are drawn; that is, of all the Indiviſible of the outer Circle and *Ellipſis*: Wherefore the Plane *Spaces* made out of them, muſt, in the whole, be in the ſame Proportion to one another; that is, the *Ellipſis* to the Circle, is as the Conjugate ab, to the Tranſverſe Diameter dC. *Q. E. D.*

COROLLARY I.

Wherefore the *Quadrature* of the *Ellipſis* will be had, when that of the Circle is found, and *vice verſa*.

COROLLARY II.

The *Ellipſis* is a mean Proportional between the greater and leſſer Circle; For a Circle, or any ſimilar Figure on ab: will be to one of the ſame Kind on de : : As ab: To a third Proportional; *i. e.* As the *Ellipſis* : Is to the greater Circle : : So is the leſſer Circle : To it, *viz.* as ab to de.

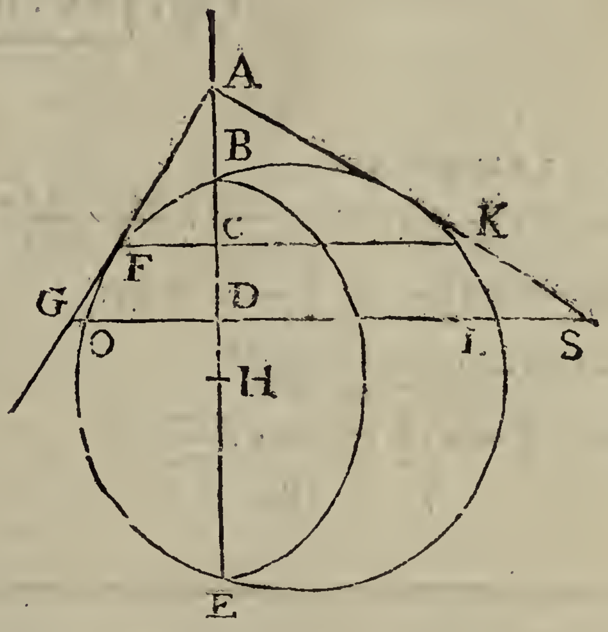
The

The Inveſtigation of the Tangent to the Ellipſe.

Let $BE = q$, $BC = x$, $FC = y$, $CD = n$; $AC = t$.

BE the Tranſverſe Ax, H the Center, F A the Tangent, F C, O D Ordinates.

C D is ſuppoſed indefinitely ſmall.



$AC^q : FC^q :: AD^q : GD^q$,	By Similar Triangles,
But $GD^q = OD^q$,	Becauſe C D is indefinitely ſmall.
Wherefore $AC^q : FC^q :: AD^q : OD^q$,	
But $FC^q : OD^q :: EC \times BC : ED \times BD$,	By the Curve's Property.
Therefore $AC^q : AD^q :: EC \times BC : ED \times BD$, $\quad\;\; \| \qquad \| \qquad\quad \| \qquad\qquad \|$	By Equality of Proportion.

$t^2 : t^2 + 2tn + n^2 :: qx - xx : qx - x^2 + qn - 2nx - n^2$	The laſt Step in Symbols.
Wherefore $t^2 qn - 2nxt^2 - n^2 t^2 = 2tnqx - 2tnx^2 + n^2 qx - nnxx$	By forming an Equation, and caſting off the Terms common on both Sides.
Therefore $t^2 q - 2xt^2 - nt^2 = 2tqx - 2tx^2 + nqx + nx^2$	By dividing all by n.
And conſequently $t^2 q - 2xt^2 = 2tqx - 2tx^2$	Caſting off n, or putting $n = 0$.
Wherefore $tq - 2xt = 2qx - 2xx$	By dividing all by t.
And therefore $t = \frac{2qx - 2xx}{q - 2x}$. *Q. E. I.*	By dividing by $q - 2x$.

PROPOSITION I.

I ſay, $\boxed{AC : CE :: AC : CH.}$

$t : 2q - 2x :: x : q - 2x$	By the laſt Equation reſolv'd into an Analogy.
Wherefore $t : q - x :: x : \frac{q}{2} - x$ $\| \qquad \| \qquad\quad \| \qquad\quad \|$ $AC : CE :: BC :: CH$. *Q. E. I.*	By dividing the ſecond and fourth Term by 2.

PROPO-

PROPOSITION II.

I ſay, $\boxed{HC : HB :: HB : HA}$

$\frac{q}{2}-x:x::q-x:t$	By the laſt Step of the laſt Propoſition.
Wherefore $\frac{q}{2}-x:x::q-x:\frac{2qx-2xx}{q-2x}$	By ſubſtituting the Value of *t*.
And therefore $\frac{q}{2}-x:\frac{q}{2}-x+x::$ $q-x:q-x+\frac{2qx-2xx}{q-2x}$	By Compounding.
That is, $\frac{q}{2}-x:\frac{q}{2}::q-x:\frac{q^2-qx}{q-2x}$ $\Vert \qquad \Vert \qquad \Vert$	By caſting off Contradictories.

Or, $\frac{q}{2}-x:\frac{q}{2}::q-x:\frac{q^2}{q-2x}-\frac{qxx}{q-2}$	By expreſſing the laſt Term in two Parts.
But $q-x:q-x+x::\frac{q^2}{q-xx}-\frac{qx}{q-2x}$ $:\frac{q^2}{q-2x}-\frac{qx}{q-2x}+\frac{qx}{q-2x}$	By compounding the two laſt Terms.
That is, $q-x:q::\frac{q^2}{q-2x}-\frac{qx}{q-2x}$ $\frac{q^2}{-q2x}$	Caſting off Contradictories.
But $q-x:\frac{q^2-qx}{q-2x}::\frac{q}{2}-x:\frac{q}{2}$	By a Step before.
Wherefore $\frac{q}{2}-x:\frac{q}{2}::q:\frac{q^2}{q-2x}$	By Equality of Proportion.
And conſequently, $\frac{q}{2}-x:\frac{q}{2}::\frac{q}{2}:\frac{q^2}{2q-4x}$	By Dividing the two laſt Terms by 2.

HC : HB :: HB : HA.

Sir *Iſaac Newton*, *Prop.* XI. *Prob.* 6. of *Princip. Philoſoph. Mathemat.* demonſtrates, That if any Body revolve round another in an Ellipſis, the Centripetal Force or Gravity of it will be in a duplicate Ratio, or as the Square of its Diſtance from the *Umbilicus* or *Focus*.

ELMINTHES, or *Helminthes*, [Ἑλμινθες, Gr.] are little Worms bred in the Guts; eſpecially that called *Rectum*, or the Lowermoſt, the Strait or Great Gut.

ELODES, or *Helodes*, [Ἑλώδης, Gr.] a ſort of Fever accompanied with a violent and perpetual Sweating.

ELONGATION, in Aſtronomy, ſignifies the removal of a Planet to the fartheſt Diſtance it can be from the Sun, as it appears to an Eye placed on the Earth; but this is moſt commonly taken notice of in *Venus* and *Mercury*.

The utmoſt Elongation of *Venus* can be but 45 Degrees, and that of *Mercury* but of 30 Degrees; which is the Reaſon this Planet is ſo rarely ſeen.

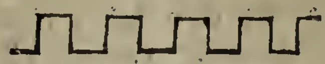
ELONGATION, in Chirurgery; is an imperfect Luxation, occaſioned by the ſtretching or lengthening of the Ligaments of any Joint. *Blanchard.*

ELOPEMENT, is when a married Woman departs from her Huſband and dwells with an Adulterer; for which, without voluntary Reconcilement to the Huſband, ſhe ſhall loſe her Dowry; nor ſhall the Huſband in ſuch caſe be compelled to allow her any *Alimony*.

ELYTHROIDES, or *Vaginalis*, [Ἐλυθροειδὴς, of ἔλυτρον a Sheath, and εἶδος, Gr. Shape.] is a ſecond proper Tunick which immediately involves the *Teſtes*.

EMANCIPATION, a Term in the *Roman* Law, ſignifying the ſetting free of a Son from the Subjection of his Father; which was ſo hard by the *Roman* Law, that (they ſay) before the Son could be releaſed from ſuch Subjection, he ſhould be ſold (imaginarily) three times by his natural Father to another Man; and this Perſon the Lawyers call *Pater Fiduciarius*, a Father in Truſt; after this he was to be bought again by the natural Father, and then on his manumitting of him he became Free. Now they called this imaginary Sale *Mancipatio*, and conſequently, the ſetting of any Perſon free from it, *Emancipation*. *Blount.*

EMBATTELED, or *Crenelle*, a Term in Heraldry, when the out-line of any *Ordinary* is of this Figure,



which repreſents the Battlements of a Wall or Caſtle.

EMBER-WEEKS, are thoſe Weeks in which the *Ember-Days* fall. In the Laws of King *Alfred* c. 39. and in thoſe of *Canute*, c. 16. they are called *Ymbren*, i.e. *Circular-Days*; from whence they are corrupted into *Ember-Days*: And by the Canoniſts they are called, *Quatuor Anni Tempora*, the Four Cardinal Seaſons on which the Circle of the Year turns: They are the *Wedneſday*, *Friday*, and *Saturday*, after *Quadrageſima* Sunday; after *Whitſunday*; after *Holy-Rood-Day* in *September*; and after St. *Lucy's-Day* in *December*: Which four Times anſwer well enough to the four Quarters of the Year, Spring, Summer, Autumn, and Winter. And Mr. *Somner* thinks, they were Faſts inſtituted to beg God's Bleſſing on the Fruits of the Earth. Theſe Ember-Weeks are now chiefly taken notice of on the Account of the Ordinations of Prieſts and Deacons; becauſe the Canon now appoints the Sundays next ſucceeding the Ember-Week, for the ſolemn Times of Ordination. Tho' the Biſhops, if they pleaſe, may ordain on any Sunday or Holy-day.

EMBLEMENTS (in Law) are the Profits of Lands which have been ſowed; but ſometimes it is taken more largely, for any Profits that ariſe and grow naturally from the Ground, as Graſs, Fruit, Hemp, &c. If the Tenant for Life ſow the Land, and afterwards die, the Executor of the Tenant for Life ſhall have the *Emblements*, and not he in Reverſion: But if a Tenant for Years ſow the Land, and before he hath reaped his Term expires, there the Leſſor, or he in Reverſion, ſhall have the *Emblements*.

EMBOLISMICAL ['Εμϐολισμικὸς, Gr.] Intercalary.

EMBOLISM ['Εμβολισμὼς of ἐμϐάλλω, Gr. to Inſert,] is the exceſs of the *Solar Year* above the *Lunar*, whereby the *Lunations* happen every ſubſequent Year, eleven Days ſooner than in the foregoing; which, when they amount to thirty Days, make a new Month, called the *Emboliſmical Lunation*, or *Emboliſmatical Month*; which muſt be added, to make the common *Lunar Year* equal to the *Solar*.

EMBOLUS is the Sucker of a Pump or Syringe, which, when the Pipe of the Syringe is cloſe ſtopt, can't be drawn up but with the greateſt difficulty; and, when forced up by main Strength, will, on being let go, return with great Violence.

The *Ariſtotelians* attribute this Effect to the common Notion of Nature's Abhorrence of a *Vacuum*. But Mr. *Boyle* found, that in his exhauſted Receiver the Sucker would be as eaſily drawn up, tho' the orifice of the Pipe were cloſe ſtopt, as it would be when open in the common Air. From whence it ſeems plain, that the difficulty of drawing back this *Embolus*, or Sucker, when the End of the Syringe is ſtopt, ariſes from the preſſure of the Atmoſphere on the external End of the Sucker, which having at the other End no counter Preſſure, nor Spring of the Air to balance it, muſt preſs with all its weight and keep down the Sucker; but when by pumping the Air out of the Receiver this Preſſure, or its equivalent Spring of the Air is taken away, there is nothing to keep down the Sucker, and ſo it may eaſily be drawn up. He found alſo, That when the Sucker could *in vacuo* thus eaſily be drawn back, yet on the re-admiſſion of the Air it would be forc'd in again, and raiſe along with it a conſiderable Weight, which was ſuſpended at the external End of the Sucker. *Vide Continuation of Phyſico-Mechan. Exp.* Part 1.

EMBRACERY, is the Offence of an *Embraceur*; to pre-inſtruct the Jury.

EMBRACEUR, or *Embraſour* (in Law) is he that when a Matter is in Trial between Party and Party, comes to the Bar with one of the Parties (having received ſome Reward ſo to do) and ſpeaks in the Caſe, or privily labours the Jury, or ſtands there to over-look and ſurvey them, thereby to put them in Fears and Doubt of the Matter, the Penalty whereof is 20 *l.* and Impriſonment at the Juſtice's Diſcretion. But Perſons learned in the Law may ſpeak in the Caſe of their Clients.

EMBRASURE [*in Architecture*] is the Enlargement made of the Gap or Aperture of a Door or Window on the inſide the Wall.

EMBRASURES [in *Fortification*] are the Holes in a Parapet, thro' which the Cannons are pointed to Fire into the Moat or Field: They are generally 12 Foot diſtance from one another; every one of them being from 6 to 7 Foot wide without, and about 3 within; their height above the Platform is 3 Foot on that Side toward the Town, and a Foot and an half on the other Side toward the Field, that ſo the Muzzle may be ſunk on occaſion, and the Piece brought to ſhoot low.

EMBRE, or *Embring-Days*, are thoſe by the Antients called *Quatuor Tempora*, and are of great Antiquity in the Church; being obſerved on the *Wedneſday*, *Friday*, and *Saturday* next after *Quadrageſima* Sunday, *Whitſunday*, *Holy-Rood Day* in *September*, and St. *Lucy*'s *Day* in *December*, 2 and 3 *Edward* VI. *c.* 19.

EMBROCATION, [from ἐμβροχὴ, *Irrigation*, or Wetting) is a kind of Fomentation, wherein the fomenting Liquor is let diſtil, drop by drop, or very ſlowly, upon the part of the Body to be fomented.

EMBROCHE [of 'Εμβρέχω, Gr. to Water] a Fomentation.

EMBRYO, ['Εμβρυον, Gr.] is the *Fœtus* in the Womb of the Mother, before its Members come to be diſtinctly form'd.

EMBRYOTOMY ['Εμβρυοτομια of 'Εμβρυον and τέμνω, Gr. to cut] the Anatomical Diſſection of an *Embryo* or *Fœtus*.

EMBRYULCUS [of 'Εμβρυον and ἕλκω, Gr. to draw] an iron Hook with which Chirurgeons pull a *Fœtus* out of the Mother's Womb.

EMBRYOTHLASTES [of 'Εμβρυον and θλάω, Gr. to bruiſe] an Inſtrument to break the Bones of a *Fœtus* for the eaſier extraction of it out of the Womb.

EMENDATIO, in the *Law*, is the Power of amending and correcting Abuſes according to ſtated Rules and Meaſures. *L.* As,

EMENDATIO *Panni*, is the Power of *Aulnage*, or *Ulnage*, or looking to the aſſize of Cloth, that it be of the juſt Ell, or due Meaſure. *L.*

EMENDATIO *Panis & Cerviſiæ*, is the aſſize of Bread and Beer; or the Power of ſuperviſing and correcting the Weights and Meaſures belonging to them. *L.*

EMERGENT, the ſame with *Emerſion*.

EMERGENT *Year* [in *Chronology*] is the Epocha, or Date whence any Nation bring their account of Time, as from the *Creation*, the Birth of *Chriſt*, &c.

EMERSION [in *Aſtronomy*] is the Time when any Planet that is eclipſed begins to *emerge* or get out of the Shadow of the eclipſing Body. When any Body alſo, lighter in Specie than Water, being thruſt violently down into it, riſes again, 'tis ſaid to *emerge* out of the Water; and this is the moſt proper Signification of the Word.

EMERSION [in *Phyſicks*] is the riſing of any Solid above the Surface of a Fluid, eſpecially lighter than itſelf, into which it had been violently immerged or thruſt.

EMETICK [’Εμετικὸς of ἐμέω, Gr. to vomit,] or *Vomitive Medicines*, are thoſe which, with their pungent Particles, contract the Fibres of the Stomach upward, and ſo eject at the Mouth whatever is offenſive to the Stomach, as is the commonly receiv'd Notion. But D. *Purcel*, in his Book of *Vapours* *p.* 39. ſuppoſes that Vomiting is cauſed by Salts, which prick and corode the Nerves of the Stomach, from whence the Spirits flow to the Brain in great quantity; and either by the proximity of the origin of thoſe Nerves, or by the angle of Incidence, they are forced into the Nerves belonging to the Diaphragm, and the Muſcles of the lower Belly; both which contracting themſelves, ſqueeze the Stomach into a leſs compaſs, and ſo make it eject its Contents; and tho' ſome part of the Matter may go downwards by the *Pylorus*, yet the far greater Quantity muſt go upwards, becauſe when the Diaphragm is contracted, it forces down the Liver, and makes it compreſs the *Pylorus*, and hinder any Thing from paſſing out that way; and this account he confirms by the Experiments of Dr. *Chirac*, an eminent Anatomiſt at *Montpellier* in *France*, and of his own made upon Dogs above twenty times: and how he ſolves the difficulty of the Muſcles of the Diaphragm, and of the Abdomen contracting themſelves both at the ſame time, when they are really *Antagoniſts* to one another, you will ſee in his Book, *p.* 43.

EMETICK *Tartar*, is only Cream or Cryſtal of *Tartar* powder'd and mix'd with a quarter part of *Crocus Metallorum*, and then the Mixture is boiled in an earthen Pan in a ſufficient quantity of Water, for about 8 or 9 Hours: It muſt be ſtirred about continually, and new Water put in as the former boils away. The hot Liquor at laſt is ſtrained thro' a woollen Cloth, and then about half of it is gently evaporated; the reſt is ſet to cool; and it will ſhoot into Cryſtals. 'Tis a fine, gentle, yet certain Vomitive. The Doſe from 3 or 4 Grains to 10 or 12.

Dr. *Cheyne*, in his Book of *Fevers*, ſays, the action of vomiting by a Medicine is produced thus: The Particles of the Vomitory, by wedging themſelves into the Orifices of the Emiſſaries of the Glands, which are placed adjacent to the ſurface of the Stomach, do dilate the ſame (which, by ſome extrinſical Cauſe, had been contracted) and after the ſame manner do diſſolve (at leaſt in ſome degree) the coheſion of the ſtagnant morbifick Matter, rendring it more fluid, and conſequently making its Reſiſtance leſs. Now the natural and conſtant action of the Glands being Secretion, and the Impediment (by the dilatation of the Orifice, and the attenuation of the Fluid) being taken away, or at leaſt made leſs than the natural *Momentum* of the Glands, the Matter muſt neceſſarily flow into the cavity of the Stomach, till it be heap'd up in ſuch a quantity (which not being to be done in an Inſtant, muſt require ſome Time) as is ſufficient (by the united Loathſomneſs, and the *Vis Stimulans* of the Emetick) to villicate and force the Fibres of the Stomauh, *Abdomen* and *Diaphragm* (by the communication of the Nerves of the firſt with the two laſt) into a violent Contraction, and thereby throw all out by the *Oeſophagus*; and this makes all quiet for a while, till a new and ſufficient quantity be excerned from theſe Glands to reproduce the aforeſaid Contraction. And thus there happens a Fit of Vomiting and Quiet alternately, till either all the morbifick Matter be thrown out, or the Force of the Emetick is ſo dilated, that it is no longer able to elicit the morbifick Matter from the Glands. And the ſtrong Contraction in ſo many Muſcles and muſcular Canals as are at work in the action of Vomiting, and the violent Concuſſion which is produced over the whole Body, by a Power which, by juſt Computation, is not inferior to that of 26000 *lb.* Weight, may, and often does take away the Obſtructions in many other Canals beſides thoſe which are adjacent to the Stomach and Gullet; as we may plainly ſee by thoſe vaſt Sweats which plentiful Fits of Vomiting occaſion. Emeticks and purgative Medicines differ only in this, that the Particles of the latter do not immediately vellicate the Fibres of the Stomach, dilate the Orifices, and attenuate the Matter contained in the Glands of the Stomach, but act gently, and aſſiſt the natural Motion of Digeſtion, and ſo are carried down into the Inteſtines; and how they operate there, ſee under *Purgatives*.

EMINENCE [in *Geography*] a little Hillock or Aſcent above the level of the Champaign.

EMINENTIAL *Equation*, is a Term uſed by the Algebraiſts in their Inveſtigation of the Areas of curvilineal Figures; and is ſo called, becauſe 'tis an artificial Equation, which contains another Equation eminently. See *Hayes's Fluxions*, *p.* 97, *&c.*

EMISSARY *of a Gland*, is the common Conduit, Canal, or *Pelvis*, in which all the little ſecretory Canals of a Gland do terminate. See *Gland* and *Animal Secretion.*

EMMENAGOGUES [of ’Εμμηνὰ Womens Monthly Courſes, and ἀγωγὸς, Gr. a Leader] are Medicines which excite the Menſes.

EMMOTON [’Εμμοτον, Gr.] is a Liquid Medicine which is injected into Ulcers.

EMOLLIENTIA, *ſoftning Things*, are ſuch as with a moderate Heat and Moiſture diſſolve thoſe Parts which before cohered cloſe; and diſſipating others, make them looſe and ſoft. *L.*

EMPALEMENT, according to our Learned Dr. *Grew*, is the outmoſt Part of the Flower of a Plant encompaſſing the Foliation of the Attire: 'Tis compounded of the three general Parts of all Plants, the Skin, the Cortical, and the Ligneous Bodies, each Empaler being (whether conſiſting of one or more Pieces) as another Leaf, and is deſigned to be a Guard and a Band to the Flower where it is weak and tender; and therefore ſuch Plants as have Flowers with a firm and ſtrong Baſis, as Tulips, *&c.* have no Empalement, nor need any.

EMPANNEL, in Law, ſignifies the Writing and Entring the Names of a Jury into a Parchment Schedule or Roll of Paper by the Sheriff, which he hath ſummon'd to appear for the Performance of ſuch publick Service as Juries are employ'd in.

EMPARLANCE, in Common Law, ſignifies a Deſire or Petition in Court of a Day, to pauſe what is beſt to do: And 'tis called by the Civilians *Petionem induciarum.*

EMPASMA, [Ἔμπασμα, Gr.] the ſame with *Catapaſma*.

EMPASTING, [in *Painting*,] the laying on of Colours, thick and bold; or the applying ſeveral Lays of Colours, ſo as they may appear thick.

EMPATTEMENT, according to ſome, is the ſame with *Talus* in Fortification; which ſee.

EMPHYTEUSIS [of Ἐμφύτευσις, Gr. a Graft,] in the Civil Law, is a Contract made by Conſent, but created by the *Roman* Law, and not the Law of Nations; by which Houſes or Lands are given, to be poſſeſs'd for ever, upon Condition that the Lands ſhall be improv'd, and that a ſmall yearly Rent ſhall be paid to the Proprietor. The Tenant is call'd,

EMPHYTEATA, becauſe of his being under an Obligation of planting and improving the Land.

EMPHATICAL, is uſed in two Senſes; when any thing is ſpoken with great Earneſtneſs and Emotion of Mind, we ſay, 'twas ſpoken very *Emphatically*, or with a great *Emphaſis*. 'Tis uſed alſo by the old Natural Philoſophers for thoſe apparent Colours (as they would call them) which are often ſeen in Clouds before the Riſing, or after the Setting of the Sun, or thoſe in the Rainbow, &c. And theſe, becauſe they are not permanent or laſting, they will not allow to be true Colours: But ſince theſe *Emphatical Colours* are Light, modified chiefly by Refraction, and with a Concurrence of Reflections, and ſome other accidental Variations; and being the proper Objects of Sight, and capable as truly to affect it as other permanent Colours are, there is no reaſon for excluding them from the Number of true and genuine Colours, ſince all other Colours are only Modifications of Light as theſe are.

EMPHRACTICK [of Ἐμφράσσω, Gr.] the ſame with *Emplattomena*, or *Emplaſticks*.

EMPHRAXIS [Ἔμφραξις, Gr.] is an Obſtruction in any Part.

EMPHYSEMA [Ἐμφύσημα of ἐμφυσάω, Gr. to blow up,] is an Inflammation, or a windy Swelling or Blowing up any Part of the Body. *Blanchard.*

EMPHYTON *Thermon* [Ἔμφυτον innate, and θέρμον, Gr. warmth,] or *Calor innatus*, is the innate Heat, or Heat firſt ſuppoſed to be produc'd in the Fœtus from the Parent's Semen, which afterwards, when Reſpiration is begun, and the Fœtus ſubſiſts of it ſelf, decays forſooth, by Degrees. Many Philoſophers and Phyſicians call this Heat an *innate* or *native Spirit*, and ſay, that it conſiſts of three Parts, of a *primogenial Moiſture*, an *innate Spirit*, and *Heat*. Whence *Fernelius* defines *innate Heat* to be a *primogenial Moiſture every way qualified with an innate Spirit and Heat*. Blanchard.

EMPIRICAL *Medicine*, now-a-days called *Quacking*, is a practiſing Phyſick, without enquiring either into the Nature of the Diſeaſe, or of the Medicines employed to cure them; but depending ſolely on the Authority of experienc'd Medicines, which are uſually apply'd too univerſally in all Caſes and Circumſtances alike. *Acron Agrigentinus* was the firſt Author of it, who neglecting the Reaſons of Things, contented himſelf with bare Experience.

Quacks firſt flouriſhed among the *Egyptians*; from this Trade came *Mountebanks*; and thoſe that now practice Phyſick after this bold and heedleſs rate are called *Empiricks*.

EMPIRICKS [Ἐμπειρικὸς of ἐμπειράω, Gr. to try,] are the ſame with Mountebanks, or bold ignorant Pretenders to the Practice of Phyſick. However *Empirical* Medicines, as ſome are pleaſed to call the very beſt in uſe, are by no means totally to be ſlighted, nor that Practice of this Art, which is built on Experience, to be condemn'd; but only the daring attempts of ſuch ignorant Pretenders as are no way qualify'd to judge of the Symptoms of a Diſeaſe, nor the peculiar Circumſtances of their Patients Temper and State of Body.

EMPLASTRUM [Ἔμπλαστρον, Gr. *a Plaſter*,] is a Medicine applied outwardly to the Skin, ſpread upon Linnen or Leather: It is commonly made of Oils, or of thoſe Things which are of a like conſiſtence with Oil; as Swine's-greaſe, Butter, ſlimy viſcous Extractions from Gums, Roots, &c. Alſo of Powder and Wax, or theſe Things which are of a like Conſiſtence with Wax, as Roſin, Pitch, Gum, &c. The Maſs whereof, being yet hot, is formed into a Cylindrical Figure. *Blanchard.*

EMPLASTICKS, } Ἐμπλαστικὰ of ἐμπλάσσω,
EMPLATTOMA } Gr. to put into a Maſs,] are Salves which ſo conſtipate and ſhut up the Pores of the Body, that ſulphurous Vapours cannot paſs. *Blanchard.*

EMPNEUMATOSIS, [Ἐμπνευμάτωσις, of ἐμπνευματόω, to inſpire,] is an alternate Dilatation of the Thorax, whereby the external Air is continually breathed in, and by the Wind-pipe and the Lungs, is communicated to the Blood to accend it. *Blanchard.*

EMPORIUM, is often uſed for the *commmon Senſory* in the Brain.

EMPROSTHOTONUS [of Ἔμπροσθεν before, and τόνος, Gr. tenſion, &c.] is a continual Contraction of the Muſcles of the Neck towards the Foreparts. *Blanchard.*

EMPTIO-*Venditio* [in the *Civil Law*] is that Contract, by Conſent only, which we call Buying and Selling, whereby the Seller is bound to deliver the Goods, and the Buyer to pay the Price for them, according to the Bargain.

EMPYEMA [Ἐμπύημα, Gr.] properly ſo called, is a Collection of purulent Matter in the cavity of the *Thorax*; but largely taken, ſignifies the ſame in the *Abdomen* too. *Blanchard.*

EMPYREUMA [Ἐμπύρευμα, Gr.] is that Taſte and Smell of Fire which ſome Things, too haſtily diſtill'd retain.

EMPYREUMATA [Ἐμπυρεύματα of Ἐμπυρεύω, are little Feveriſh Remains after a *Criſis*; alſo that thick viſcous Matter which ſubſides to the Bottom in diſtilled Waters. *Empyreuma* ſignifies alſo that Taſte and Smell of the Fire which in Diſtillations affects ſome Oils, Spirits and Waters, by reaſon of their being drawn off by too great a Degree of Heat.

EMRODS. See *Hæmorrhoids*.

EMULGENT *Veſſels*, are the two large Arteries and Veins which ſpring, the former from the deſcending Trunk of the *Aorta* or great Artery, the latter from the *Vena Cava*. They are both inſerted into the Kidneys, and the *Emulgent Arteries* carry the Blood (with the *Serum*) to them, and the *Emulgent Veins* bring it back again after the *Serum* is ſeparated from it by the Kidneys.

EMULSION, is a Liquid Medicine to be taken inwardly, of the Form and Colour of Milk, whence comes its Name, (*Quaſi Lac mentiens.*)

EMUNCTORIES, are the Cavities into which the Excrements of an Animal Body are emptied, as the pituitous Humour of the Brain, into the Noſtrils; the yellow thickiſh Humour, which we call Ear-wax, into the Ears; the Excrements, into the Bowels; the Urine, into the Bladder, *&c.*

ENÆMON ['Εναιμων, Gr.] is a Medicine which ſtops the Blood, or which, by binding, cooling or drying, cloſes the Paſſages of the Veſſels which were open; ſtops or diminiſhes the Fluidity and violent Motion of the Blood. *Blanchard.*

ENÆOREMA ['Εναιορεμα, Gr.] is that Craſs Subſtance which is ſuſpended in the middle of the Urines, call'd the *Hypoſtaſis Urinæ. Blanchard.*

ENALLAGE, a Figure in Grammar, whereby there is a Change either of a Pronoun, as when a Poſſeſſive is put for a Relative, as *Suus* for *Ejus*; or a Verb, when one *Mood* or *Tenſe* is put for another, *&c.*

ENALURON, the Term in Heraldry for a Bordure charged with *Martlets*, or any Kind of Birds: Thus they ſay, he beareth *Argent*, a *Bordure Azure*, charged with an *Enaluron of Martlets*; meaning, that there are *Martlets* all round the *Bordure.*

ENARTHROSIS [Ενάρθρωσις of ἐν and ἄρθρον, Gr. a Joint,] is (in *Anatomy,)* a kind of Jointing, when the Cavity that receives it is deep, and the Head of the Bone that is inſerted is oblong, as may be ſeen in the Huckle-bone and its Cavity; in the principal Bone of that Part of the Foot which immediately ſucceeds the Leg, with the Bone call'd *Cymbiforme.*

ENCATHIS, or *Encanthis*, is the *Caruncula Lachrymalis*; which ſee.

ENCAUMA ['Εγκαυμα, Gr.] or *Epicauma*, is a deep, hard, and cruſty Ulcer of the Eye. *Blanchard.*

ENCAUSTICE ['Εγκαυστικὴ, Gr.] is the Art of *Enameling.*

ENCHESON, is a *French* Word often uſed in our Law-Books, and ſeems to ſignify, the Occaſion, Reaſon, or Cauſe of any Thing's being done.

ENCIENTE, a *French* Term, in Fortification, ſignifying the whole Encloſure, Circumference, or Compaſs of a Fortified Place, whether compoſed of Baſtions or not.

ENCEPHALOS ['Εγκέφαλος, Gr.] is whatſoever is within the Compaſs of the Skull, as the Brain, the *Cerebellum*, the *Medulla Oblongata*, *&c.*

ENCHARAXIS: See *Scarificatió.*

ENCHEIRESIS *Anatomica*, ['Εγχείρεσις, Gr.] is a Readineſs in Diſſections, when an *Anatomiſt* ſhews the Parts of a Body dexterouſly and expeditiouſly.

ENCHYMOMA [Εγχύμωμα, Gr.] is an afflux of the Blood, whereby the external Parts are render'd black and blue; as in the Scurvy, Bloodſhot Eyes, *&c.* Alſo an afflux of the Blood by the quickneſs and ſuddenneſs of its Motion, as in *Anger* and *Joy. Blanchard.*

ENCHYTA ['Εγχυτὴ, Gr.] or *Infundibulum*, is an Inſtrument wherewith Liquids are inſtilled into the Eyes, Noſtrils, and Ears.

ENCHYSMA, the ſame with *Clyſter.*

ENCOPE ['Εγκοπὴ, Gr.] is an Inciſion of any Part, as in a Gangrene, *&c.*

ENCOLAPTICE ['Εγκολαπτικὴ, Gr.] is the Art of making Plates of Braſs, and cutting in the Figures or Letters for Monumental Inſcriptions and Laws.

ENCRANIUM ['Εγκράνιον, Gr.] the ſame with *Cerebellum.*

ENCROACHMENT, or *Accroachment*, [in *Common Law*,] ſignifies an unlawful gaining upon the Right or Poſſeſſions of another.

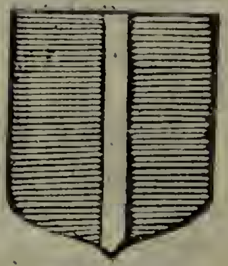
END *for End*: When a Cable, Hawſer, or other Rope of a Ship, is run clear off from the Block or Place it was wound about, they ſay at Sea, *'Tis run out End for End.*

ENDECAGON ['Ενδεκάγον, Gr.] a plain Figure in Geometry, of eleven Sides and Angles.

ENDEIXIS ["Ενδειξις of ἐνδείκνυμι, Gr. to ſhew,] is an Indication of Diſeaſes, whereby is ſhewn what is to be done: As for Example, a *Plethora*, or too great Fulneſs of Blood, indicates the opening of a Vein. *Blanchard.*

ENDEMICAL [of "Ενδημος, Gr. peculiar to a People,] *Endemial*, or *Endemious Diſeaſe*, is what ſome call *Morbus Vernaculus*, & *Communis*; that is, a Diſeaſe which always infects a great many in the ſame Country, proceeding from ſome Cauſe peculiar to the Country where it reigns: Such is the Scurvy to the *Hollanders*; intermitting Fevers to the Inhabitants of our Submarine and Marſhy Places, *&c.*

ENDITEMENT, or *Indictment*, [in *Common Law*,] is the ſame with *Accuſatio* in the Civil Law, tho' in ſome Points it differs. It may be thus defined: An *Indictment* is a Bill or Declaration made in Form of Law, (for the Benefit of the Commonwealth) exhibited as an Accuſation of one for ſome Offence, either Criminal or Penal, unto Jurors, and by their Verdict found and preſented to be true, before an Officer, having Power to puniſh the ſame Offence. It is always at the Suit of the King, and differs from an *Accuſation* in this, that the *Preferrer* is no way tied to the Proof thereof, upon any Penalty, if it be not proved, except there appear Conſpiracy.



ENDORSE, a Term in Heraldry, ſignifying the $\frac{1}{8}$ Part of a *Pale*; and ſome ſay it is not uſed but when the *Pale* is between two of them; but this *Guillim* finds fault with as too bold a Saying.

He beareth *Or*, an Endorſe *Gules.*

ENDORSED, when two Lions are born rampant, and turning their Backs to each other, the Heralds ſay they are *Endorſed*; but if their Faces be toward each other, they call it *Combatant.*

ENDOWMENT, ſignifies the giving or aſſuming of a Dower to a Woman; alſo the ſetting or ſevering of a ſufficient Portion for a Vicar towards his perpetual Maintenance when the Benefice is appropriated; and ſuch a Vicarage is called a *Vicarage Endow'd.*

ENDOWMENT *de la plus belle part*, is where a Man dying, ſeized of ſome Lands holden in Knight's Service, and other ſome in Soccage, the Widow is ſped of her Dower, rather in the Soccage Lands, than thoſe holden in Knight's Service, as being *le plus belle part*, the fairer Part.

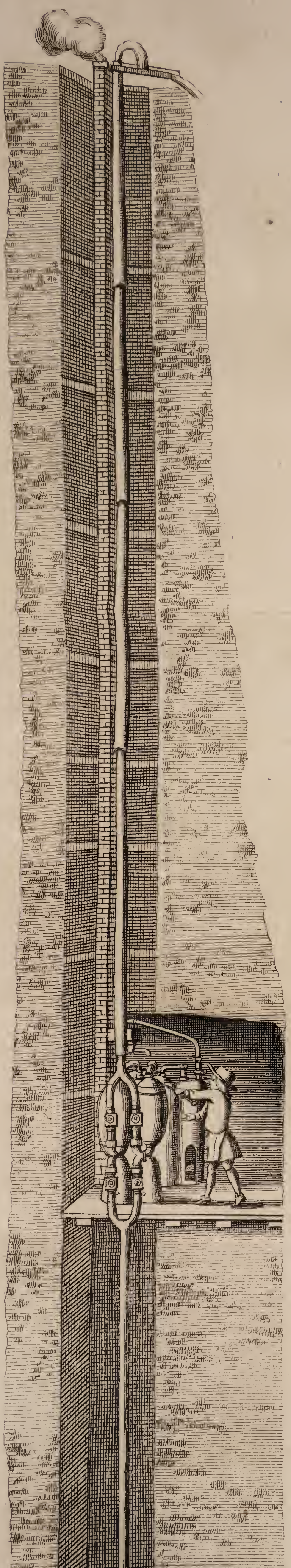
ENEMA ['Ενεμα, Gr.] the ſame with *Clyſter.*

ENERGETICAL *Bodies*, or *Particles*, are ſuch as are eminently active, and which produce manifeſt Operations of various Natures, according to the various Circumſtances and Motions of ſuch Bodies or Particles.

ENERGY ['Ενέργια, Gr.] in a medicinal Senſe, is an agitation, or operation, of the animal Spirits and Blood.

ENFANS *Perdues*, the ſame with *Forlorn Hope* in an Army; which ſee.

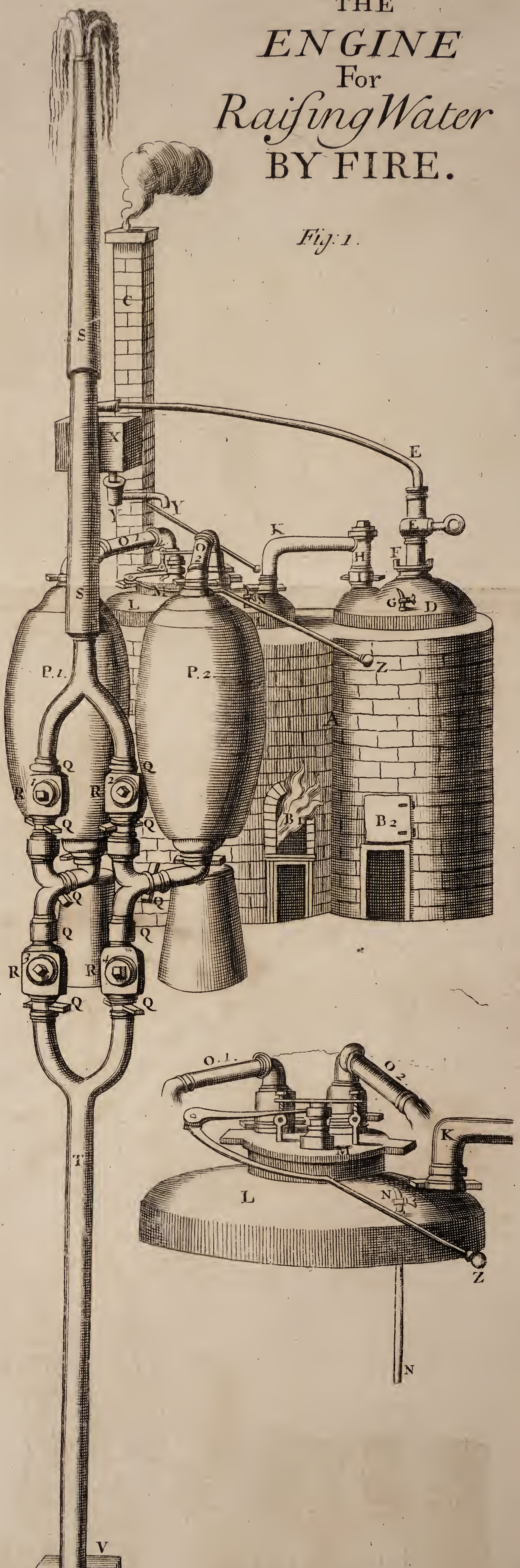
Fig: 2.



The
ENGINE
Working in a
MINE.

THE
ENGINE
For
Raiſing Water
BY FIRE.

Fig: 1.



Place this at the word Engine

B. Lens delin: I. Sturt ſculp:

ENFILADE [in *Fortification*] ſignifies a Situation of Ground which diſcovers a Poſt according to the whole Length of a right Line, ſo that it can be ſcoured with the Cannon, and rendred almoſt defenceleſs. Wherefore to

ENFILE, or *Enfilade* the Curtain or Rampart, is to ſweep the whole Length of it with the Cannon.

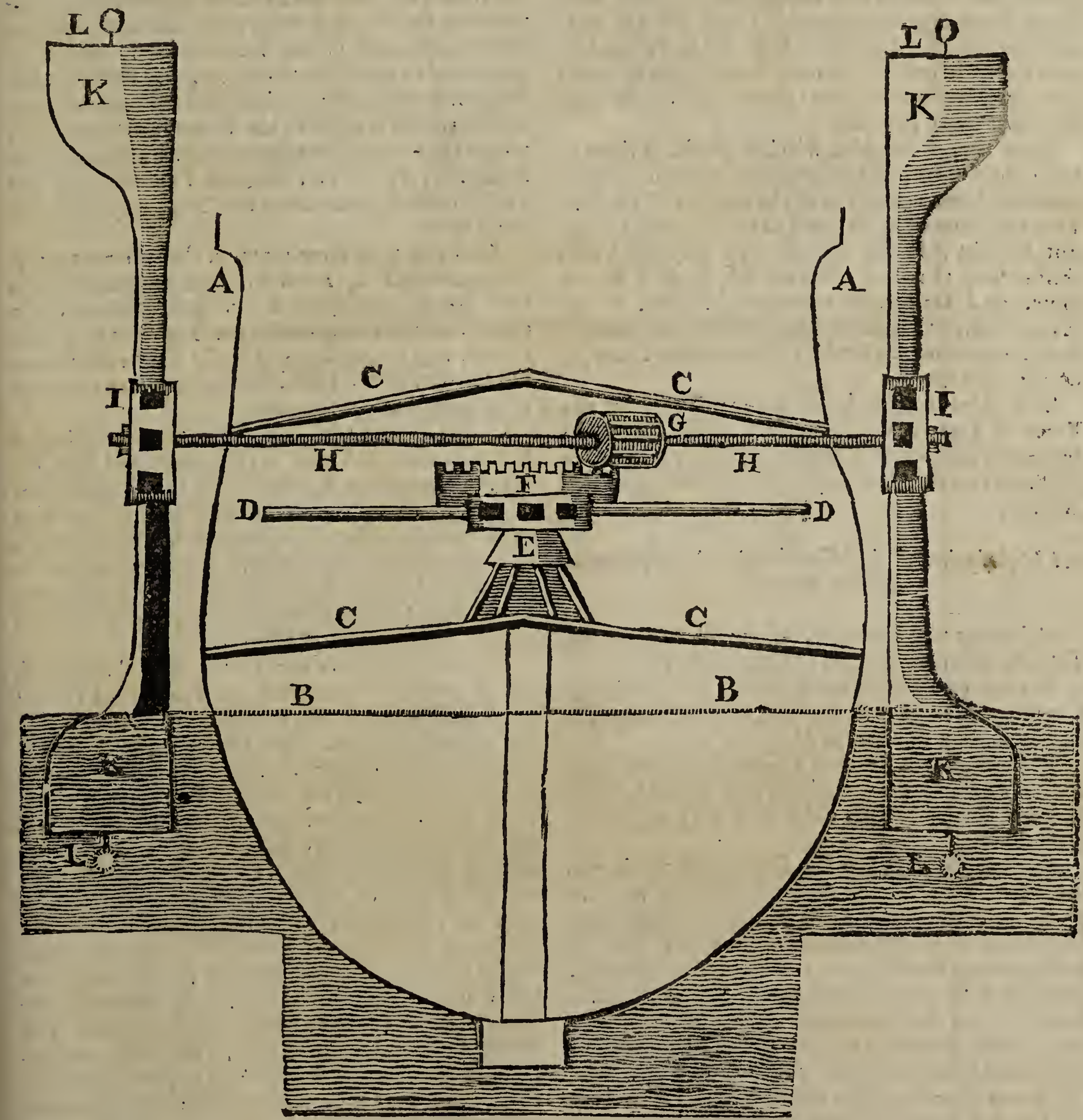
ENFRANCHISE, to make Free, to incorporate a Man into a Society or Body-politick, or to make one a Free *Denizon.*

ENGINE, in the general, is any Mechanick Inſtrument compoſed of Wheels, Screws or Pulleys, in order to lift, caſt, or ſuſtain any Weight, or to produce any conſiderable Effect which cannot ſo eaſily be obtained by the bare application of Mens Hands without ſuch help; ſuch as Warlike *Engines*, *Engines* to raiſe Water, Cranes, *&c.*

And here I think it proper to give the Reader a Deſcription of two very uſeful *Engines*, which are the Invention of one of our own Nation, *Thomas Savery*, Eſq; a Gentleman very ſkilful in all Things of this Nature, and late Treaſurer to the Sick and Wounded Office..

The Firſt is an *Engine* to row Ships and Boats at Sea, or in a River, when there is a ſtark Calm, or very little Wind.

A Deſcription of this the Inventor publiſhed in the Year 1698, with his Anſwers to the Objections raiſed againſt it by Mr. *Dummer*, and others: And



Deſcription of the Engine.

A. The Line the Ship makes.
B. The Water Line.
C. The Decks.
D. The Capſtand Bars.
E. The Capſtand.
F. A Wheel on the Drumhead of the Capſtand.
G. A Trundle-head on the Wheel.
H. An Iron Bar going through the Trundle-head and thorough the Sides of the Ship.
I. Two Drum-heads like thoſe on the Capſtand.
K. Paddles, of which Six or Eight on each Side the Ship, are with eaſe fixed and unfixed into the ſaid Drum-heads.
L. A Piece of Iron, to which a Luff-Tackle may be fix'd, to lift thoſe that are too heavy for Mens Strength, round each of which, by taking half Turns with a Cord, you make a compleat Wheel on each Side the Veſſel.

the Thought is ſo natural, and the Manner of its working ſo plain and eaſy, that 'tis an amazing thing to one that there is no more uſe made of it.

He fits a Wheel to the Drum-head of the Capſtan, whoſe Teeth turn a Trundle-head; through which is run an Iron Bar that reaches clear a-croſs, and goes through the Sides of the Ship; and on its Ends, without Board, at a convenient Diſtance from the Ship's Sides, are faſtened two Drum-heads like that on the Capſtan, in which are fitted, to take out at pleaſure, 6 or 8 Paddles; and at the outermoſt Ends of the Paddles is faſtened an Iron Pin with an Head to it; by which means, and by the help of a Cord, taking an half turn round about all theſe Pins, both the Paddles may be ſwifted or ſtrain'd, and ſtrengthned ſo, that they ſhall all work proportionably; and alſo the Paddles may with a Luff Tackle be the more handily and eaſily lifted in and out, in order to be fitted into or taken out of the Drum-heads of the Bar: See the Figure annexed.

Now here if the Men will but work, if there be enough of them, and the Paddles be made proportionably large, according to the number of the Men that can be brought to work at the Capſtan; I cannot ſee but that the *Engine* will give the Veſſel freſher way than any Oars can do, work'd by the ſame, or a far greater number of Hands, as the Experiments that have been tried do abundantly ſhew, according to the beſt Information I can get of the Matter.

The other *Engine* is for raiſing Water by the Force of Fire, in which he hath ſhewed as great Ingenuity, Depth of Thought, and true mechanick Skill, as ever diſcovered itſelf in any Deſign of this Nature.

A Deſcription of this Fire-Engine is as follows. See the Figure.

A denotes two Furnaces, whoſe Fire-places are *B*, 1, 2, and their Funnel or Chimney *C*.

In theſe two Furnaces are placed two Veſſels of Copper, which he calls *Boilers*, the one a larger, as *L*, the other a ſmaller, as *D*.

Theſe Boilers have each a *Gage Pipe*, as *G* and *N*, of which *G* goes within eight Inches of the Bottom, but *N* reaches only half way down the great Boiler.

By theſe Pipes, before the *Engine* can work, you muſt firſt fill the ſmall Boiler quite full, and the great Boiler two Thirds full of Water: Then light the Fire at *B* 1, and make the Water in *L* boil, by which means the Steam of it being quite confined, muſt needs be wonderfully compreſſed, and therefore will, on the opening of a Way for it to iſſue out, (which is done by turning *Z* the Handle of the Regulator from you) ruſh with a great Force thro' the *Steam Pipe O* 1, into the Receiver *P* 1, driving all the Air before it, and forcing it up into the Force-Pipe through the Clack *R* 1, as you will perceive by the Noiſe and Rattling of the Clack. And when all the Air is thus driven out, the Receiver *P* 1, will be very much heated by the Steam: When you find that it is throughly emptied, and is grown very hot, as you may both ſee and feel, then pull the Handle of the Regulator towards you, by which means you will ſtop the Steam-Pipe *O* 1, ſo that no more Steam can yet come into it, but you will open it a way into *O* 2, and by that means fill the Receiver *P* 2, with the Steam, as the other was before. While this is doing, let ſome cold Water be poured on the Receiver *P* 1, by which means the Steam there being cooled, and condenſed, and contracted into a very little room, and conſequently preſſing but very little (if at all) on the Valve or Clack *R* 1, at the Bottom of the Receiver *P* 1. there is nothing there to counterbalance the Preſſure of the Atmoſphere on the Surface of the Water in the lower Part of the Sucking-Pipe *T*; wherefore it will be preſſed up, and aſcend into, and fill the Receiver *P* 1, driving up before it, as it riſes, the Clack or Valve *R* 3, which afterwards falling down again and ſhutting cloſe, hinders the Deſcent of the Water that Way.

Then (the Receiver *P* 2, being in the mean time emptied of its Air) turn the Handle of the Regulator from you, and the Force of the Steam coming from the Boiler, will be all upon the Surface of the Water contained in the Receiver *P* 1, where it gravitates or preſſes hard upon it, and ſtill increaſes its Spring or Elaſticity till it comes to over-balance, or exceed the Weight of the Water in the Receiver; which then it will neceſſarily drive up through the Paſſage *Q*, *R*, 1, *Q*, *Q*, into the Force-Pipe *S*, and at laſt diſcharge it out at the Top, as you ſee in the Figure.

After the very ſame manner, tho' alternately, is the Receiver *P* 2, filled with and emptied of Water; and by this means a conſtant Steam is kept continually running out at the Top of the Force-Pipe *S*, and ſo the Water is raiſed very eaſily from the Bottom of the Mine, &c. to the Place where it is deſigned to be diſcharged.

Only I ſhould add, That after the *Engine* begins to work, and the Water is riſen into, and hath filled the Force-Pipe *S*, then it fills the little Ciſtern *X*, and by that means feeds the Pipe *YY*, which he calls the *Condenſing-Pipe*, becauſe Water is conveyed down from thence to cool the Receivers when throughly heated by the Steam, in order to make them *Suck* (as 'tis uſually called) the Water out of the Well up into the Receiver.

Alſo a little above that Ciſtern goes the Pipe *E*, which conveys Water from the Force-Pipe into *D* the leſſer Boiler, which is there placed to repleniſh the greater Boiler *L* when the Water in it begins to be almoſt conſumed. Now when there is need of doing this, turn the Cock *E* ſo, that there can be no Communication between the Force-Pipe *S*, and the leſſer Boiler *D*; and putting in a little Fire at *B* 2, the Water there will grow preſently hot; and when it boils, its own Steam, which hath no vent out, preſſing on its Surface, will force the Water up the Pipe *H*, through *K*, into the great Boiler *L*, and ſo long will it run till the ſurface of the Water in the Boiler *D*, get to be as low as the bottom of the Pipe *H*; and then the Steam and Water will run together, and by its Noiſe and rattling of the Clack *I*, will give him that works the *Engine* ſufficient aſſurance that *D* hath emptied and diſcharged it ſelf into *L*, and carried in as much Water as is then neceſſary; after which, by turning the Cock *I* again, you may let new cold Water out of *S* into *D* the leſſer Boiler, as before; and thus there will be a conſtant Motion, and a continual Supply of the *Engine* without fear of Decay or Diſorder.

Alſo to know whether *L* want repleniſhing or not, you need only turn the Cock *N*, and if Water come out, there is no need to repleniſh; but if Steam only come you may conclude there is: and the like will the Cock *G* do in reference to the leſſer Boiler *D*, ſhewing when 'tis neceſſary to ſupply that with freſh Water from *S*; ſo that in working the *Engine* there is very little Skill or Labour required, it being only to be injured by either a ſtupid or wilful Neglect.

Of the Uſes and Application of this *Engine*, the Reader will find a full Account in the Inventor's Book called the *Miner's Friend.*

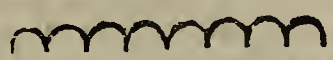
ENGIZOMA [Ἐγγίζωμα of ἐγγίζω, to draw near, Gr.] is a Blow upon the Skull, wherewith the Bone deſcends to the inner Membrane of the Brain, and preſſes upon it. Alſo an Inſtrument in ſuch like Caſes. *Blanchard.*

ENGLECERY, *Englecerìa*, is an old Word ſignifying to be an *Engliſhman*: For in the Time of the *Danes*, if a Man were privily ſlain or murdered, it was accounted *Francigena*, which Word then comprehended every *Alien*, until *Englecery* was prov'd, that is, till it was made manifeſt that he was an *Engliſhman*, *Vid. Bracton*, *Lib.* 3. *Tract.* 2. *Cap.* 15. *Fol.* 134. But there being many Abuſes and Troubles about this *Englecery*, it was taken away by 14 *Ed.* III. *Cap.* 4.

ENGONASIS [Ἐγγόνασις, Gr.] *Hercules*, the Name given by *Aſtronomers* to one of the Northern Conſtellations, containing about 48 Stars.

ENGONIOS [Ἐγγόνιος, Gr.] is the bending of the Arm or Leg.

ENGRAILED, a Term in *Heraldry*, when a Bordure, &c. is formed by a Line of this Shape;



and the little Arches turn outward from the Center of the Eſcutheon; for if they turn the other way 'tis called *Invected.*

ENGYSCOPE [Ἐγγυσκόπη of ἐγγὺς near, and σκοπέω, Gr. to view,] the ſame with a *Microſcope*, being an Inſtrument to view ſmall Bodies diſtinctly; and 'tis ſo called becauſe it brings the Eye much nearer to theſe ſmall Bodies, and conſequently makes them appear to us to have larger Parts and Dimenſions than they had before. See *Microſcope.*

ENHARMONICAL, } a Term in *Muſick*, uſu-
ENHARMONICK, } ally applied to the laſt of the three kinds of *Muſick*, abounding in *Dieſis*, which are the leaſt ſenſible Diviſion of a Tone. See *Dieſis.*

ENIGMA [Αἴνιγμα, Gr.] or *Riddle*, is an obſcure Allegory, where the natural Senſe of the Words are not preſently perceptible, being, in appearance, frequently Contradictory.

ENIXUM-SAL, is the Chymical Term for what they otherwiſe call a *Neutral Salt*, which participates both of the Nature of an *Acid* and an *Alkali*; as *Common Salt*, *Nitre*, *Allum*, *Vitriol*, &c.

ENNEADECATERIDES [of Ἐννεατεειδος of nine Years, and δέκα, Gr. ten;] the ſame with the *Golden-Number*, which ſee; or the *Cycle of the Moon*

ENNEAGON [of Ἐννεατὴς, and γωνία, Gr. an angle,] is a Polygon of nine equal ſides.

ENNEATICAL *Days*, [of Ἐννεατὴς of nine,] ſignifies every ninth Day of a Sickneſs, which ſome will ſuppoſe doth bring ſome great alteration in the Diſeaſe.

ENNEATICAL *Years*, are every ninth Year of ones Life, which, by ſome weak Men, are thought to bring a great Mutation of Fortune along with them.

ENNEEMIMERIS [in *Grammar*,] is one kind of the *Cæſura* of a *Latin* Verſe; where, after the fourth Foot, there is an odd Syllable ending a Word, which helps to make the next Foot with the following Word; as in this Inſtance,

Ille latus Niveum Molli fultus Hyacintho.

Where all the four kinds of the *Cæſura* occur.

ENORTHROSIS, See *Diarthroſis.*

ENQUEST, is taken for an Inquiſition by a Jury, which is the moſt uſual Trial in all Cauſes both Civil and Criminal within this Realm; for in Cauſes Civil, after Proof is made on either ſide of ſo much as each Party thinketh good for himſelf, if the Doubt be in the Fact, it is referr'd to the Diſcretion of twelve indifferent Men, empanell'd by the Sheriff for that Purpoſe; and as they bring in their Verdict, ſo Judgment paſſeth; for the Judge ſaith, The Jury findeth the Fact thus, and the Law is thus. For the *Enqueſt* in Criminal Cauſes, ſee *Jury.*

ENS, or *Being*, is whatever hath any kind of Being or Exiſtence; for that which hath no Exiſtence nor Eſſence, is really nothing at all. This the Schools (who make a great Variety of Beings) call *Ens Reale*, and *Ens Poſitivum*, to diſtinguiſh it from their *Ens Rationis*, which is only an imaginary thing, a Creature of the Brain, and exiſts no where but in the Underſtanding.

ENS PRIMUM, according to the Cant of *Paracelſus*, is the moſt efficacious Part of any natural mixt Body, Vegetable, Animal, or Mineral, which he pretends to have been able to ſeparate from them, and with it to effect prodigious things towards the renovation and reſtoration of Youth: And though he delivers his Proceſſes ſo obſcurely, as to encourage no body to try them; yet Mr. *Boyle* gives us a Proceſs of Mr. *L. F.* Chymiſt to the *French* King, whereby the *Ens Primum*, or Eſſence of any Vegetable, may eaſily be obtained, as he had tried himſelf, and is as follows.

Gather, at a convenient Seaſon of the Year, and Time of the Day, *Balm*, for Inſtance, or ſome other fitting Herb, (for all Plants cannot this way be turned into Water) beat it to a ſoft Maſs or Pulp in a Marble Mortar, and then putting it into a Bolt-head hermetically ſealed, digeſt it for 40 Days in a Dunghil, or ſome analogous Heat: After this take out the Matter, which will now be much more liquid than before, and ſeparating from it the Dregs or groſſer Parts, digeſt it anew in a gentle Bath, that the remaining groſſer Parts alſo may ſubſide; filtrate it, and then add to it the fix'd Salt drawn from the former Dregs, dried and calcined. To this prepared Liquor add equal Parts of the Liquor of good Sea-Salt, well purified, melted, and then let it run *per Deliquium*. Seal up then the Mixture in a Bolt-head, and let it be expoſed to the Sun for ſix Weeks longer; at the end of which Term there will ſwim upon the Liquor the *Ens Primum* of the Plant in a liquid tranſparent Form, ſometimes of a green, and ſometimes of a reddiſh Colour, according to the Nature of the Plant thus managed.

Mr. *Boyle* ſays, That Mr. *L. F.* aſſured him once, in the preſence of another Virtuoſo, to whom he appealed for the Truth of the Fact, as having been made acquainted with the Operation, That a ſpecial Friend of his thus drawing the Eſſence of Balm, tried it upon himſelf for about a Fortnight, taking it according to *Paracelſus* his Deſcription; before the end of which Time the Nails of his Hands and Feet came off without Pain, being ſucceeded by a

Sett of new ones; and convinced him ſo far of the Efficacy of it, that he having no need of any ſuch help, left off taking it; and tried it no farther; but that giving it to an old Woman of 70 Years of Age, who ſerved in the Houſe, it produced the *Menſes* again, and that ſo copiouſly, as wonderfully to ſtartle the old Woman.

Nay, he told Mr. *Boyle* farther, on his enquiring why he did not try it on Beaſts, That he gave of it, tho' but in a little quantity, as having not much of it left, to an old Hen, who on the ſixth Day began to moult her Feathers till ſhe grew ſtark naked; but before a Fortnight was paſſed, received others in their room, which were fairer and better coloured than the former Feathers.

This is an odd Relation, but however 'tis eaſy make Trial of Matter of Fact; and I wonder no one hath attempted all this while to proſecute a thing which is ſo eaſy to effect, and whoſe Succeſs would reward ſufficiently the Explorer's Pains and Time, if it will do.

ENS *Veneris*, is a Sublimation of equal Parts of the Powder of *Cyprus Vitriol*, calcined till 'tis of a dark Colour, and of *Sal-Armoniack* into the Form of a Yellow Flower; and they are ſo called from ſome Particles of Copper which they have carried away from the Vitriol. The Chymiſts calling Copper *Venus*.

Mr. *Boyle* commends them as an admirable Medicine in the Rickets, obſtinate Cachexies, Loſs of Appetite, and all Obſtructions. Their Doſe is from ſix Grains to a Scruple.

ENSCONSED. See *Inſconſed*.

ENSIFORMIS *Cartilago*, or *Mucronata*, is the loweſt Part of the *Sternum*, or the Breaſt-Bone; and becauſe of its pointed triangular Shape, 'tis called *Mucronata* and *Enſiformis*: 'Tis about an Inch long, and on the outſide of it there is formed a Cavity in the Breaſt called *Scrobiculus Cordis*, or the Heart-Pit; and a gnawing Pain which is ſometimes felt here, is called *Cardialgia*, the Heart-burn: But this Pain proceeds not from the Heart, but from the upper orifice of the Stomach, which lies under this Cartilage, and hath the Name of *Cardia*, becauſe of its great Conſent with the Heart, as ſome fancied formerly.

ENTABLATURE, or *Entablement*, a Term in *Architecture*, ſignifying the *Architrave*, *Friſe*, and *Cornice* of a Pillar, being, in effect, the Extremity of the Flooring, which is either ſupported by Pillars, or by a Wall, if there are not Columns.

ENTAYLE, in *Common Law*, ſignifies *Fee-tail*, or *Fee-intailed*, or *Abridged*.

ENTELECHIA [Ἐντελέχεια, Gr. Perfection,] a Word uſed by *Ariſtotle* to expreſs the Human Mind: They tell us, that *Hermolaus Barbarus* went to the Devil to know the Meaning of it; and either the Devil for him, or his own great Underſtanding, renders it *Perfectihabia*; by which his Readers are much the wiſer.

The ancient Commentators on *Ariſtotle* interpret it by the Word *Actus*, and mean by it a kind of *Subſtantial Form*, by which *Action* is produced in the Body.

The modern Peripateticks come nearer to what perhaps was *Ariſtotle*'s Meaning; for they make a kind of Motion and happy Modification of Matter qualifying the Whole, to be able to perform ſuch *Acts* as are proper to it: And thus *Cicero* in his *Tuſcul. Queſt.* renders *Entelechia*, *quædam quaſi Continuata & perennis Motio*.

ENTERENCHITA, is a Clyſter-Pipe, which is alſo called *Siphon* and *Syringa*.

ENTEROCELE [Ἐντεροκήλη, of ἔντερον, an Entrail, and κήλη, Gr. a Rupture] or *Hernia Inteſtinalis*, is the fall of the *Inteſtines*, eſpecially of the *Ilium*; thro' the Proceſſes of the *Peritoneum*, dilated inro the Groins, or outward Skin that covers the *Scrotum*. *Blanchard*.

ENTEROEPIPLOCELE [Ἐντεροεπιπλοκήλη, Gr.] a ſort of Rupture in which the Guts and Caul fall down into the *Scrotum* together. *Blanchard*.

ENTEROMPHALUS [Ἐντερόμφαλος of ἔντερον and ὀμφαλὸς, Gr. a Navel,] or *Hernia Umbilicalis*, a Rupture of the Navel, or the bunching out of the Guts at the Navel, which is common with Teeming Women.

ENTERPLEADER, in *Common Law*, ſignifies as much as *Cognitio præjudicialis* in the *Civil*; that is, the diſcuſſing of a Point incidentally falling out before the principal Cauſe can take end. For Example, Two ſeveral Perſons being found Heirs to Land, by two ſeveral Offices in one County, the King is brought in doubt to which of them Livery ought to be made, and therefore firſt they muſt *Interplead*; that is, formally try between themſelves who is the right Heir.

ENTHYMEME [Ἐνθύμημα, Gr. a Conception of the Mind] is a Syllogiſm perfect in the Mind, but imperfect in the Expreſſion; becauſe ſome one of the Propoſitions is ſuppreſt, as being too clear and common, and eaſily to be ſupplied by the Underſtanding of thoſe with whom we diſcourſe: as, *Every Right-lined Triangle hath all its three Angles juſt equal to two Right ones*; *therefore it will be ſo in an Iſoſceles*; where the Propoſition, that an *Iſoſceles is a Right-lined Triangle*, is omitted, as being ſufficiently known, and therefore it would have been impertinent to have inſerted it.

ENTIRE *Tenancy*, is contrary to *Several Tenancy*, ſignifying the ſole Poſſeſſion in one Man, whereas the other ſignifieth Joint or Common in more.

ENTOYRE, the Term in Heraldry to Blazon a Bordure when it is charged with things without Life, ſuch as *Bezants*, *Plates*, &c.

ENTRING-LADDER, in a Ship, is of two Sorts; one is uſed by the Ship's Sides, in a Harbour, or in fair Weather, for Perſons to go in and out of the Ship; the other is made of Ropes, with ſmall Staves for Steps, and is hung out of the *Gallery* to enter into the Boat, or to come aboard the Ship from thence, when the Sea runs ſo high, that they dare not bring the Boat to the Ship's Side for fear of *Staving* of her.

ENTRUSION, [in *Law*,] ſignifies a violent or unlawful Entrance into Lands or Tenements, being utterly void of a Poſſeſſor, by him that hath no Right unto them.

ENTRUSION *de gard*, is a Writ that lies where the Infant within Age, entred into his Lands, and held his Lord out; for in this Caſe the Lord ſhall not have the Writ *de communi Cuſtodia*, but this.

ENTRY, a Term in Law, ſignifies properly the taking Poſſeſſion of Lands or Tenements: 'Tis uſed alſo for a Writ of Poſſeſſion.

And in the Plea of *Entry* there be three Degrees.

Firſt, Where a Man demandeth Lands or Tenements of his own *Seiſin*, after the Term is expired.

The Second is, Where one demandeth Land or Tenements let by another, after the Term is expired.

The Third, Where one demandeth Lands or Tenements of that Tenant that had *Entry* by one to whom ſome Anceſtor of the Plaintiff did let for a Term now expired; according to which Degrees, the Writs for more fit Remedy are varied.

A Writ of *Entry* differeth from an Aſſiſe, becauſe it lieth for the moſt part againſt him who entred lawfully, but holdeth againſt Law; whereas an Aſſiſe lieth againſt him that unlawfully diſſeiſed: Yet ſometimes a Writ of *Entry* lieth upon an *Intruſion*.

There are Five Things which put the Writ of *Entry* out of the Degrees, *viz. Intruſion*, *Succeſſion*, *Diſſeiſin* upon *Diſſeiſin*, *Judgment*, and *Eſcheat*.

1. *Intruſion*, is where the Diſſeiſor dies ſeiſed, and a Stranger abates.
2. *Succeſſion*, is when the Diſſeiſor is a Man of Religion, and dies, or is diſpoſſeſſed, and his Succeſſor *Enters*.
3. *Diſſeiſin* upon *Diſſeiſin*, is when the Diſſeiſor is diſſeiſed by another.
4. *Judgment*, is when one recovers againſt the Diſſeiſor.
5. *Eſcheat*, is when the Diſſeiſor dies without Heir, or doth Felony, whereby he is Attaint, by which the Lord *Enters*, as in his *Eſcheat*.

ENTRY *ad Communem Legem*, is a Writ which lies where Tenants for Term of Life, Tenant for Term of another's Life, Tenant by the Courteſy, or Tenant in Dower, aliens and dies, he in the Reverſion ſhall have this Writ againſt whomſoever is in. *L.*

ENTRY *ad Terminum qui præteriit*, lies where a Man Leaſes Land to another for Term of Years, and the Tenant holds over his Term, the Leſſor ſhall have this Writ. *L.*

ENTRY *cauſa Matrimonii prælocuti*, is a Writ which lies where Lands or Tenements are given to a Man upon Condition, That he ſhall take the Donor to his Wife within a certain Time, and he eſpouſes another, or othewiſe diſables himſelf that he cannot take her according to the ſaid Condition; then the Donor and her Heirs ſhall have the ſaid Writ againſt him, or againſt whoever elſe is in the ſaid Lands. *L.*

ENTRY *in caſu proviſo*, lies if Tenant in Dower aliens in Fee, or for Term of Life, or for another's Life living the Tenant in Dower, he in the Reverſion ſhall have this Writ. *L.*

ENTRY *in Caſu conſimili*, is a Writ that lies where Tenant for Life, or Tenant by the Courteſy aliens in Fee, he in the Reverſion ſhall have this Writ. *L.*

ENTRY *ſine aſſenſu Capitali*, lies where an Abbot, Prior, or ſuch as has Convent or Common Seal, aliens Lands or Tenements of the Right of the Church, without the Aſſent of the Convent or Chapter, and dies, then the Succeſſor ſhall have this Writ. *L.*

ENVELOPE, [in *Fortification*,] is a Mount of Earth, ſometimes raiſed in the Ditch of a Place, and ſometimes beyond it, being either in form of a ſimple *Parapet*, or of a ſmall *Rampart* bordered with a *Parapet*. Theſe *Envelopes* are made when one would only cover the weak Places with ſingle Lines, without any Deſign of advancing toward the Field, which cannot be done but by Works that require a great deal of Breadth; ſuch as *Horn-works*, *Half-Moons*, *&c.*

Theſe *Envelopes* are ſometimes called *Sillons*, *Contregards*, *Conſerves*, *Lunettes*, *&c.*

ENUNCIATION, with the Logicians, is the ſame as a Propoſition.

ENURE, in the *Law Senſe*, ſignifies to take Place, or Effect, or to be Available. As a Releaſe ſhall *Enure* by way of Extinguiſhment; and a Releaſe made to a Tenant for Term of Life, they ſay, ſhall *Enure* to him in Reverſion.

ENURNY, the Herald's Term for a *Bordure* of a Coat of Arms being charged with any kind of Beaſts.

ENVY, is by ſome well enough defined to be an Uneaſineſs of the Mind, cauſed by the Conſideration of a Good we deſire, obtained by one we think ſhould not have had it before us.

EPACMASTICA, is a Fever that commonly grows ſtronger. *Blanchard.*

EPACT, is uſed for a Number, whereby we note the Exceſs of the common *Solar Year* above the *Lunar*, and thereby may find out the Age of the Moon every Year: For the *Solar Year* conſiſting of 365 Days, the *Lunar* but of 354, the *Lunations* every Year get 11 Days before the *Solar Year*; but thereby in 19 Years the *Moon* compleats 20 times 12 *Lunations*, or gets up one whole *Solar Year*; and having finiſhed that Circuit, begins again with the *Sun*; and ſo from 19 Years to 19 Years: For the firſt Year afterwards, the *Moon* will go before the *Sun* but 11 Days; the ſecond Year 22 Days, which is called the *Epact* of that Year; the third Year 33 Days; but 30 being an entire Lunation, caſt that away, and 3 ſhall be that Year's *Epact*; the next Year 14; and ſo on; adding yearly 11 Days, and caſting away 30, when the Number amounts to more.

To find the Epact, *having the* Prime *or* Golden Number *given, you have this*

RULE.

Divide by 3, *for each one left add Ten.*
30 *reject*; *the* Prime *makes* Epact *then.*

Example.

Anno 1701, *Golden Number* 11, divided by 3, leaves 2; therefore 10 times 2, which is 20, added to 11, makes 31, from which take 30, the Remainder is 1, the *Epact* for the Year 1701.

EPANORTHOSIS ['Επανόρθωσις, Gr.] the ſame with *Correctio* or *Emendatio* in *Latin*, and ſignifies a pathetical Form of Speech, in which the firſt Expreſſion appearing too weak, the Speaker ſtill endeavours to correct or mend it, by uſing ſtronger ways of ſpeaking.

EPAR. See *Hepar.*

EPARMATA, ['Επάρματα, Gr.] are Tumors of the Glandules, called *Parotes*, behind the Ears. *Blanchard.*

EPAULE, in *Fortification*, is the Shoulder of the Baſtion, or the Angle of the *Face* and *Flank*; whence that Angle is often called the Angle of the *Epaule.*

EPAULEMENT, *in Fortification*, is a *Sidework* made either of Earth thrown up, of Bags of Earth, Gabions, or of Faſcines and Earth, of which latter make the *Epaulments* of the *Places of Arms* for the Cavalry behind the Trenches are. Sometimes the Word

EPAULMENT is uſed for a *Demi-Baſtion*; and ſometimes it ſignifies a *Square Orillon*, which is a Maſs of Earth almoſt Square, faced and lined with a Wall, and deſigned to cover the Cannon of a *Cazemate.*

EPENTHESIS ['Επένθεσις, Gr.] in *Grammar*, is the addition of a Vowel or Conſonant in the middle of a Word; but if it be prefix'd, 'tis called *Protheſis*, if added at the End *Paragoge*.

EPHELÆUM, is the Place from the *Hypogaſtrium*, or Part of the *Abdomen*, to the Secret Parts. *Blanchard*.

EPHELIS [Ἐφηλὶς, Gr.] or *Ephellides*, *Freckles* in the Face, Neck, or Hands, *&c.*

EPHELCIS, is that bloody Subſtance which is brought up in ſpitting of Blood: Alſo a Shell or Cruſt that is brought over Ulcers. *Blanchard*.

EPHEMERA, or *Diaria*, is a continued Fever which laſts but a Day; if it laſts above a Day, it is called *Synochus Simplex*. *Blanchard*.

EPHEMERIS [Ἐφημερὶς of ἐπὶ and ἡμέρα, Gr. a Day,] thoſe Books or Journals which contain the Daily Motions of the *Planets*, and other Circumſtances relating thereto, for every Day in the Year, are called an *Ephemeris*, or *Ephemerides*.

EPHIALTES [Ἐφιάλτης, Gr.] or *Incubus*, the *Night-Mare*, is a depraved Imagination, whereby People aſleep fancy that their Wind-pipe is opprеſs'd by ſome ſuperincumbent Body; and that their Breath is ſtopp'd: This ſeems to proceed from a Compreſſion of the *Cerebellum*, when the Ventricles are too full of Moiſture; for if thoſe who are thus affected lie upon their Backs, then the whole Bulk of the Brain lies upon the *Cerebellum*; whereupon all the Pores and Paſſages being ſtop'd by ſo much Weight, the Spirits are hindred from influencing the Nerves called *Par vagum*, and the *Intercoſtal Nerve*; which being thus deſtitute of Spirits, the Lungs are oppreſſed and flag, and cannot perform their Office. *Blanchard*.

EPHIDROSIS [Ἐφίδρωσις, Gr.] is Sweating.

EPHIMERIS, or *Ephimerides*, is a Diary or daily Regiſter of the Motions and Places of the Heavenly Bodies, eſpecially ſhewing their Place at Noon. The ſame with *Ephemeris*.

EPHIPPIUM [Ἐφίππια, Gr.] or *Sella Equina*, or *Turſica*, is part of the Bone *Sphenoides*, wherein the *Pituitary* Gland is placed.

EPIALA, a kind of continual Fever, wherein both Heat and Cold is felt at the ſame time. *Blanchard*.

EPICARPIUM [Ἐπικάρπιον, Gr.] is a Medicine applied outwardly like a Plaiſter or a *Cataplaſm*; applied to the Pulſe or Wriſt of the Hand to drive away intermitting Fevers.

EPICAUMA [Ἐπικαῦμα, Gr.] is a cruſty Ulcer that ſometimes happens to the black of the Eye.

EPICERASTICA [Ἐπικεραστικὰ, Gr.] are Medicines which obtund and temperate ſharp Humours.

EPICHEIRESIS, the ſame with *Encheireſis*.

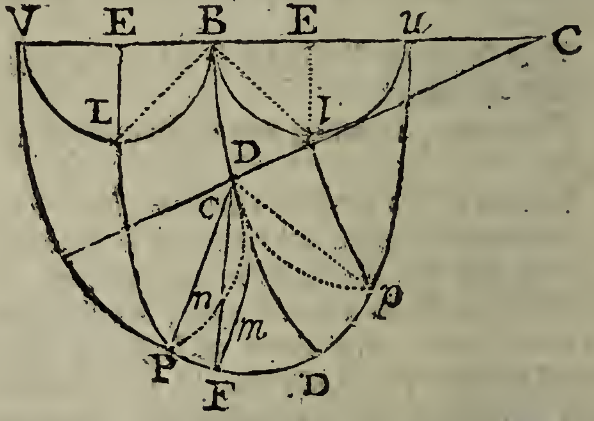
EPICHEIREMA [Ἐπιχείρημα, Gr.] is a kind of complex Argumentation conſiſting of many Propoſitions depending one upon another, whereby at laſt ſome particular Point is made out: As when *Cicero*, in his Oration *pro Milone*, argues, That thoſe who lay in wait to deprive a Man of his Life, or of his Money, may, by the Law of Nature, of Nations, and by common Practice, be juſtly ſlain: And therefore, ſince it appears that *Clodius* did by ſeveral Acts prove himſelf to be in ſuch a Deſign, 'twas lawful for *Milo* to kill him. 'Tis a kind of *Sorites*, which ſee.

EPICRASIS [Ἐπίκρασις, Gr.] is a gradual Evacuation of ill Humours in the Blood.

EPICUREAN *Philoſophy*, was the natural Philoſophy firſt taught by *Epicurus* and *Democritus*, and afterwards delivered in Verſe by *Lucretius*: It is much the ſame with the preſent mechanical Philoſophy; which ſee.

EPICYCLE [of ἐπὶ and κύκλος, Gr.] a little Circle whoſe Center is in the Circumference of a greater; or a ſmall Orb, which being fixed in the Deferent of a Planet, is carried along with its Motion, and yet with its own peculiar Motion, carries the Body of the Planet faſtened to it round about its proper Center, which ancient Aſtronomers attribute to all the Planets, for ſolving their Appearances, except the Sun.

EPICYCLOID [of Ἐπίκυκλος and εἶδος, Gr. Form,] is a Curve generated by the Revolution of the Periphery of a Circle along the *Convex* or *Concave* Part of another Circle; which Part of this other Circle is call'd the Baſe of the *Epicycloid*; as in this Figure, *D B* is the Baſe of the *Epicycloid*;



V its Vertex; *V B* its *Axis*; *D P V* half of the *Exterior Epicycloid*; made by the Revolution of the Semicircle *V L B*, (which is called the *Generant*) along the Convex Side of the Baſe *D B*: As *D P U* is the *Interior Epicycloid*, formed by the Generant's revolving along the *Concave* Side of the Baſe.

How a Portion of this *Epicycloid* is ſquatable, ſee *Phil. Tranſ. N.* 217. by Mr. *Caſwell*; and in *Phil. Tranſ. N.* 218. you have a general Propoſition for meaſuring the *Areas* of all *Cycloids* and *Epicycloids*. How to find the *Evoluta* to this kind of Curve, as alſo to find the *Areas* of *Cycloidal* and *Epicycloidal* Spaces. See *Hayes's Fluxions*, *p.* 210. &c.

EPICYEMA [Ἐπικύημα, Gr.] is a Superfœtation.

EPIDEMICK *Diſeaſe*, [of Ἐπιδήμιος, Gr. peculiar to a People,] is one proceeding from a common Cauſe, ſpreading it ſelf over divers Countries at divers times; ſuch are the Plague, Malignant Fevers, *&c.*

EPIDERMIS: See *Cuticula*.

EPIDYMIS, or *Epididymida*, [of ἐπὶ above, and δίδυμοι, Gr. the Stones or Teſticles,] or *Paraſtata*, in Latin *Supergeminalis*; it is a winding Veſſel, making a Figure like the Winding of crooked Veins that are ſwoln with ill Blood, and is affixed to the Back of the Teſticles: Its greater Globe is annexed to the Teſticles, conſiſting of one Veſſel or Paſſage above five Ells long: The leſſer Globe is connected to the Veſſel that carries the Seed. *Blanchard*. See *Teſtes*.

EPIGASTRICK *Artery*, is ſaid by ſome to be a Branch of the *Iliack Artery*; and diſtributes it ſelf amongſt the Muſcles of the *Epigaſtrius*.

EPIGASTRIUM [Ἐπιγάστριον of ἐπὶ above, and γαστὴρ, Gr. the Belly,] is the Fore-part of the *Abdomen* or *lowermoſt* Belly, whoſe upper Part is called *Hypochondrium*, the middle Part *Umbilicalis*, and the lowermoſt *Hypogaſtrium*.

EPIGLOTTIS [Ἐπιγλωττὶς, Gr.] is the fifth Cartilage of the *Larynx*, the Cover of the Opening of the Wind-pipe: It is alſo called *Sublinguium*. See *Cion*.

EPIGONATIS [of ἐπὶ and γόνυ, Gr. the Knee,] is the Whirl-bone of the Knee.

EPILEPSY [Ἐπιλεψία, Gr.] or *Morbus Caducus*, is the Falling-Sickneſs, becauſe that the Perſons affected fall down on a ſudden; or *Herculeus*, becauſe it is hard to be cured; alſo *Lues Deifica*, *Sonticus*, *Comicialis*, *Sacer*, &c.

EPINYCTIDES [of Ἐπινυκτὶς, Gr.] are Pimples that ſend forth Matter, and are painful, eſpecially in the Night. *Blanchard.*

EPIPAROXYSMUS [of ἐπὶ and παροξυσμος, Gr.] is when a Patient endures more Fits in a Fever than uſual, which happens in inordinate Converſe. *Blanchard.*

EPIPEDOMETRY [of Ἐπὶ πέδος and μετρον, Gr. Meaſure,] in Mathematicks, ſignifies the meaſuring of Figures that ſtand on the ſame Baſe.

EPIPHONEMA [Ἐπιφώνημα, Gr.] is an *Exclamation* containing ſome Sentence, or great Senſe, placed at the End of a Diſcourſe; being a preſſing and lively Reflection upon the Subject whereof we ſpeak.

EPIPHORA [Ἐπιφορα, Gr.] in general, ſignifies a Defluxion of Humours into any part; but is more eſpecially applied to denote the Defluxion of a thin Rheum from the Eyes, which is commonly called involuntary Weeping, and flows continually from the Corners of the Eyes.

EPIPHYSIS [Ἐπιφυσις, Gr.] *Appendix*, *Adnaſcentia*, *Additamentum*, ſignify one Bone that grows to another by ſimple and immediate Contiguity; though not with ſo even a Surface, but with ſome kind of Ingreſs of one Bone into the Cavity of the other; like that Coarticulation wherewith the Bones form the Joints; but without any Motion. *Blanchard.*

EPIPHYLLOSPERMOUS *Plants*, [of ἐπὶ, φύλλον a Leaf, and σπερμα, Gr. Seed,] are the ſame with the *Capillaries*, which bear their Seed on the back-part of their Leaves. See *Capillaries*.

EPIPLASMA, the ſame with *Cataplaſma.*

EPILOCELE: See *Enteroepiplocele.*

EPIPLOIS *dextra*, a Branch of the *Cœliack Artery*, which runs through the right Side of the inner or hinder Leaf of the Caul, and the *Colon* that is next to it.

EPIPLOIS *poſtica*, is a Branch of the *Cœliack Artery*, ſpringing out of the lower end of the *Splenica*, and running to the hinder Leaf of the *Omentum*, and the *Colon* annexed to it.

EPIPLOIS *ſiniſtra*, is a Branch of the *Cœliack Artery*, and is beſtowed on the lower and left Side, of the *Omentum.*

EPIPLOMPHALUM [of ἐπιπλοον and ὀμφαλος Gr.] is a Navel Rupture, when it jets out by reaſon of the Inteſtines or Caul bearing too hard upon it.

EPIPLOON [ἐπιπλοον, Gr.] *Omentum*, or *Reticula*, the Caul, is a Cover ſpread over the Inteſtines, ariſing from the bottom of the little Ventricle, and the Back of the Gut *Colon*; to wit, from the Doubling of the *Peritonæum*: It is ſhaped like a Net, or a Fowler's Bag; and abounds with ſeveral Sanguinary Veſſels. Its Uſe is to cheriſh the Stomach and the Guts with its Fat. *Blanchard.*

EPISARCIDIUM [of ἐπὶ and σαρκιδιον, Gr.] the ſame with *Anaſcara.*

EPISCOPALE *Onus*. See *Epiſcopalia.*

EPISCOPALIA, are Synodials, Pentecoſtals, and other cuſtomary Payments, from the Clergy to their Dioceſan Biſhop; which Dues were formerly collected by the Rural Deans, by them tranſmitted to the Biſhop. *L.*

Theſe cuſtomary Impoſitions were called *Onus Epiſcopale*, and were by ſpecial Privilege remitted to thoſe free Chapels as were built on the *Demeſne* of the King, and exempt from Epiſcopal Juriſdiction.

EPISEMASIA [Ἐπισημασία, Gr.] is the very Time that a Diſeaſe firſt ſeizes a Perſon; and is properly called *Significatio.* *Blanchard.*

EPISION, is the Place of the Secret Parts, or *Aqualiculus.* *Blanchard.*

EPISPASTICKS [of ἐπισπαστὸς, Gr.] the ſame with *Attrahentia*, or Bliſters.

EPISPHÆRIA [of ἐπὶ and σφαῖρα, Gr.] are Windings and Turnings in the outer Subſtance of the Brain, that the ſanguiferous Veſſels may paſs more ſecurely. *Blanchard.*

EPISTOMIA [Ἐπιστομία, Gr.] are the utmoſt Gapings and Meetings of Veſſels.

EPISTOMIUM [Ἐπιστόμιον, Gr.] in *Hydraulicks*, a Plug or Inſtrument, by the application of which, an Aperture may be opened and ſhut again at Pleaſure.

EPISTROPHEUS [Ἐπιστροφεὺς, Gr.] or *Cardo*, is the ſecond Vertebræ of the Neck; ſo called from turning, becauſe the Head turns upon it. *Blanchard.*

EPISTYLE [Ἐπιστυλὴ, Gr.] in Architecture, is a Maſs of Stone, or piece of Timber laid upon the Capital of a Pillar.

The ancient *Grecians* frequently made uſe of this Word, to ſignify that which we call the *Architrave.*

'Tis the firſt Member of the *Entablature*, and is uſually broken into two or three Diviſions, which the Architects call *Faſciæ*, Swathes, Fillets, Bands, or Liſts.

EPITHEME [Ἐπίθημα, Gr.] is a Medicine of a Liquid Form, externally to be applied to ſome particular Part.

EPITRITUS, a Foot of a Latin Verſe conſiſting of four Syllables; of which the *Grammarians* reckon four kinds.

The Firſt is compounded of an *Iambus* and a *Spondæus*, as *Salutantes*; where the firſt Syllable is ſhort, and all the reſt long.

The Second is made out of a *Trochæus* and a *Spondæus*, as *Concitati*; where the firſt Syllable is long, the ſecond ſhort, and the two laſt long.

The Third is compounded of a *Spondæus* and an *Iambus*, as *Communicans*; where the two firſt Syllables are long; the third ſhort, and the laſt long.

The Fourth conſiſts of a *Spondæus* and a *Trochæus*; as *Incantare*; where the three firſt Syllables are long, and the laſt ſhort.

EPITROPE [Ἐπιτροπὴ, Gr.] is a Figure in Rhetorick, whereby we freely grant a thing that might be deny'd, to obtain another that we deſire.

EPNEUMATOSIS, the ſame with *Expiratio.*

EPOCHA, or *Epoche*, [Ἐποχὴ, Gr.] in Chronology, ſignifies ſome remarkable Occurrence, from whence ſome Nations date and meaſure their Computation of Time.

The *Julian Epocha* takes its Name from *Julius Cæſar*'s Reformation of the *Roman* Calendar; which was done 45 Years before Chriſt, in the 708 Year from the building of *Rome*, and in the 731 Olympiad.

The *Ethiopick*, *Abyſſin*, or, as ſome call it, the *Diocleſian Epocha*; others, the *Æra* of the Martyrs, becauſe it bore Date with a very ſevere Perſecution: This *Epocha* began *Aug.* 29. *A. D.* 284. and in the firſt Year of the Emperor *Diocletian.* 'Tis uſed by the *Egyptians* and *Abyſſines.*

The *Turkiſh* or *Arabick Epocha*, which they call the *Hegira*, bears Date from *Mahomet*'s Flight from *Mecca*, *A. D.* 622. *July* 16.

The *Perſick* or *Jeſdegerdick Epocha*, takes its Date either from the Coronation of the laſt *Perſian* King *Jeſdegerdis*, or *Jeſdagerdis*, as ſome ſay; or from his being conquered rather by *Ottoman* the *Saracen*, which was *June* 16. *A. D.* 632.

EPOMIS, is the upper part of the Shoulder, called alſo *Acroneum.*

EPOMPHALUM ['Επομφάλον, Gr.] is a Plaiſter, or any ſuch thing, applied to the Protuberances of the Navel.

EPULIS, ['Επουλις, Gr.] is an Excreſcence in the Gums, which is ſo large, as ſometimes to hinder the opening of the Mouth.

EPULOTICK *Medicines* ['Επουλωτικα, Gr.] are the ſame with *Cicatrizantia.*

EQUABLE *Motions*, are ſuch as always continue the ſame Degree of Velocity, and are neither accelerated nor retarded; but if there be an acceleration or retardation of the Velocity of two or more Bodies, and it be exactly and uniformly the ſame in them both or all, they ſay ſuch Bodies are

EQUABLY accelerated or retarded.

EQUAL [*Æquales*, L.] a Term of Relation between two or more things of the ſame Magnitude, Quantity, or Quality.

EQUAL *Circles* [in *Geometry*,] are ſuch whoſe Diameters are equal.

EQUAL *Angles* [in *Trigonometry*,] are thoſe whoſe Sides are inclined alike to each other; or which are meaſured by ſimilar Parts of their Circles.

EQUAL *Figures*, are ſuch Figures, the Areas of which are equal, whether the Figures are ſimilar or not: The Segments of a Sphere or Circle are of an *equal Concavity* or *Convexity*, when they have the ſame Ratio or Proportion to the Diameter of the Spheres or Circles of which they are Parts.

EQUAL *Solids*, are ſuch as contain or comprehend each as much as the other; or ſuch of which, the Solidities or Capacities are *equal.*

EQUAL *Hyperbolas*, are ſuch whoſe Ordinates to their indeterminate Axis are equal to each other; taken at equal diſtance from their Vertexes.

EQUAL *Geometrical Ratio's*, are ſuch whoſe leaſt Terms are ſimilar, aliquot, or aliquant Parts of the greater.

EQUAL *Arithmetical Ratio's*, are ſuch in which the difference of the two leſs Terms is equal to the difference of the two greater.

EQUALITY, is the exact Agreement of two Things in reſpect of Quantity.

Circle of EQUALITY, }
Circle of the EQUANT, } [in *Aſtronomy*,] is a Circle uſed in the *Ptolemaick* Aſtronomy, to account for the Eccentricity of the Planets, *&c.*

Proportion of EQUALITY [in *Geometry*,] is that between two equal Numbers or Quantities.

Proportion of EQUALITY *evenly ranged*, is that wherein two terms in a Rank or Series, compared to each other in the ſame Order, *i. e.* the firſt of one Rank to the firſt of another; and the ſecond to the ſecond, *&c.* called alſo, *ex æquo ordinata.*

Proportion of EQUALITY *evenly diſturbed*, is that wherein two terms of a Rank are proportional to as many terms of another, compared to each other in a different and interrupted order; *viz.* the firſt of one Rank to the ſecond of another; the ſecond to the third, *&c.* call'd alſo, *ex æquo diſturbata.*

Equality in Algebra, is a Compariſon of two Quantities that are equal, both really and repreſentatively *i. e.* both equal in Effect and Letters. And *Equation* is a compariſon of two Magnitudes equal in Effect, but unequal in Letters to render them equal.

Equality in Algebra is uſually denoted by two parallel Lines as $=$ thus, $3+2=6$, *i. e.* 3 *plus* 3 are equal to 6.

From an *Equation* we arrive at an *Equality*, by changing one Letter into another, whereby the two Members of the *Equation*, *i. e.* the two Quantities compared together, and connected by the ſign of *Equality* are rendred *Equal*; thus in the equation $a\,a\,x = b\,c\,d$, ſuppoſing $x = \frac{b\,c\,d}{a\,a}$ we change x into $\frac{b\,c\,d}{a\,a}$ and by this Subſtitution arrive at the equality $b\,c\,d =$ to $b\,c\,d$.

EQUANIMITY, is an even, equal, calm frame of Mind and Temper under good or bad Fortune; whereby a Man appears to be neither Diſpirited, Soured, or rendred Uneaſy by Adverſity; nor puffed up, nor overjoy'd with Proſperity.

EQUATED *Bodies.* On *Gunter*'s Sector there are ſometimes placed two Lines, anſwering one another, and called, *The Lines of Equated Bodies:* They lie between the Lines of Solids and Superficies, and are noted with the Letters, *D*, *I*, *C*, *S*, *O*, *T*, for *Dodecahedron*, *Icoſihedron*, *Cube*, *Sphere*, *Octahedron*, and *Tetrahedron.*

Their Uſes may be theſe;

1. The diameter of a Sphere being given, to find the Side of the five regular Bodies, ſeverally, equal to that Sphere.
2. The Side of any of the Bodies being given, to find the diameter of the Sphere, and the ſides of the other Bodies, which ſhall be ſeverally equal to the firſt Body given.

If the Sphere be firſt given, take its diameter, and apply it over in the Sector in the Points *S*, *S*: If any of the other Bodies be firſt given, apply the Side of it over in its proper Points: So Parallels taken from between the Points of the other Bodies, ſhall be the Sides of thoſe Bodies, equal ſeverally to the firſt Body given.

EQUATION, or the *Total Proſtaphæreſis*, in the Ptolemaick Theory of the Planets, is the Difference between the Planets *mean* and *true* Motion; or the Angle made by the Lines of the true and mean Motion of the Center: But the

EQUATION or *Phyſical Proſtaphæreſis*, is the Difference between the Motions of the Centre of the *Epicycle* in the *Equant*, and in the *Eccentrick*; as the

EQUATION, or *Optical Proſtaphæreſis*, is the Angle made by two Lines drawn from the Center of the *Epicycle* to the Centers of the World, and of the *Eccentrick.*

EQUATION *of the Orbit*, is the ſame with the *Total Proſtaphæreſis*, or *Equation Total.*

EQUATION, [in *Algebra*,] is a mutual comparing of two equal things of different Denominations; as 3*s.* = 36*d.* 10 Crowns = 2*l.* 10*s.* = 50*s.* = 600*d.* = 2400 Farthings, *&c.* $a = b + d$, $36 = \frac{c + R}{2}$, *&c.*

The *Terms of an Equation*, are the ſeveral Quantities or Parts of which any Equation is compoſed, connected together by the Signs + and —: As in this Equation $a = b + c$, the Terms are a, b, and c, where 'tis ſuppoſed, that ſome Quantity repreſented by a, is equal to the Sum of b and c, or to b and c added together.

Whenever any Queſtion or Problem is propoſed in *Algebra*, we always ſuppoſe the thing *ſought* or *required* to be *known* or *done*; and then by putting the Letter a, or ſome other Vowel (moſt now uſe the laſt Letters of the Alphabet z, x, y) for the unknown Quantity, or for the Thing ſought, and Conſonants for whatever is *known* or *given*, in order to diſtinguiſh one from the other: The Queſtion or Problem is firſt throughly conſidered, and then duly ſtated; and after this judiciouſly compared, transformed, and varied by Addition, Subſtraction, Multiplication, Diviſion, Extraction of Roots, &c. according as the Nature of the Thing, and the Rules of Art direct; till at laſt the Quantity *ſought*, or at leaſt ſome Power of it, becomes equal to ſome *known* or *given* Quantity, and ſo is it ſelf of conſequence diſcovered.

After a Queſtion is duly ſtated, 'tis proper to conſider whether it be ſubject to any *Limitations* or not: To which end the Writers of *Algebra* give theſe general Rules.

1. If the Quantities ſought or requir'd, are more than the number of the given Equations, the Queſtion is capable of innumerable Anſwers. See *Kerſey's Algebra*, p. 301. Vol. 1.

2. But if the given Equations, independent one upon another, are juſt as many as the Quantities ſought, then the Queſtion hath only one certain and determinable number of Anſwers.

3. If the Quantities ſought or required, are leſs in number than the given Equations, the Queſtion is yet more limited, and is ſometimes diſcoverable to be impoſſible to be reſolved, by reaſon of ſuch Equations being inconſiſtent with each other.

Equations, in order to be reſolved, muſt firſt be prepared and reduced; which may be done by the following Rules.

1. If the Quantity ſought, or any Part or Degree of it be in Fractions, let all be reduced to one common Denomination, and then omitting the Denominators, let the Equation be continued in the Numerators only; *v. gr.* $\frac{a+b}{c} + d = 100 = B$. Then firſt, $\frac{a+b+cd}{c} = B$, and then $a + b + cd = cB$. Or if $a - b = \frac{aa+cc}{d} + b + b$; multiply all by d, and it will ſtand thus, $ad - db = aa + cc + db + db$. Or if $a - 75 = \frac{3}{4}bb + c - g$; multiply all by 4, then $4a - 300 = 3bb + 4c - 4g$. This is called by *Vieta*, *Iſomeria*, and by others *Converſion*.

2. When there is an intermixture of Quantities, known and unknown, in any Equation, let all the unknown Quantities (by Tranſpoſition) be made to poſſeſs only one Side of the Equation, and all the known ones another.

Tranſpoſition is always done by putting the Quantity over to the other Side with a contrary Sign to what it had before. The Demonſtration of which Rule depends on that Axiom, That if to, or from Equals, you add or ſubſtract Equals, the Sums or Remainders will be equal.

Thus, Suppoſe $a - 34 = 60$, then $a = 34 + 60 = 94$: Or if $a + b - d = b + c + e$, then $a - c = c + d$. If $4a - 300 = 3bb + 4c - 4g$; then $4a = 300 + 3bb + 4c - 4g$. If $36 + 44 = a - 60$, then $a = 140$.

3. If the higheſt Power or Species of the unknown Quantity be multiplied into any known Quantity or Quantities, let the whole be divided by ſuch known Quantity or Quantities.

Thus, If $5aa = 30000$, $aa = \frac{30000}{5} = 6000$.

If $ba + da = 100$, then $a = \frac{100}{b+d}$.

If $dee + dde = z$, then $ee + de = \frac{z}{d}$.

This is called ſometimes *Depreſſion*, and by *Vieta*, *Paraboliſmus*.

4. If all the known Quantities happen to be multiplied into any Degree of the unknown one, let all be brought down (by Diviſion) to the loweſt Degree thereof that can be.

As if $aaaa + baaa = zzaa$, then by Diviſion of all by aa, $aa + ba = zz$.

If $aa + ab - ac = ad - fa$, then $a + b - c = d - f$, by Diviſion, and $a = d - b + c - f$, by Tranſpoſition.

If $ea + 9e - 7e = 15e + 34e - 10e$, then will $a + 9 - 7 = 15 + 34 - 10$, by Diviſion.

And $a + 2 = 39$; therefore, by Tranſpoſition, $a = 37$. This Rule is that which *Vieta* calls *Hypobibaſmus*.

5. If any one Member of the Equation be a Surd Root, all muſt be raiſed up to that Power, and then the Equation continued.

Thus, if $\sqrt{:ba:} + b = c$, then, by Tranſpoſition, $\sqrt{:\overline{ab}} = c - b$, and by this Rule $cc - 2bc + bb = ab$: And by Rule the third, $a = \frac{cc - 2bc + bb}{b}$.

EQUATIONS. Captain *Halley*, in *Philoſoph. Tranſ. N.* 190. *p.* 38. gives us an Account of the Number of Roots in Cubick and Biquadratick Equations, together with their Signs and Limits. And in *N.* 210. he gives a Method for the Extraction of all Roots out of them, without any previous Reduction.

In *N.* 309. there is an analytical, geometrical, mechanical, and univerſal Method for the Reſolution of cubick and biquadratick Equations, by Mr. *J. Colſon*. And an analytical Reſolution of ſome Equations of the 3, 4, 5, 7, 9, and ſuperior Powers; and ſo on infinitely, in finite Terms, and in ſuch a Method as *Cardan* uſed for Cubicks.

Dr. *Gregory*, in the Preface to his exellent *Oxford Euclide*, in *G. L.* ſhews, that from the 86th and 87th Propoſition of *Euclides Data*, even biquadratick Equations, where the 2d and 4th Terms are wanting, may be reſolv'd. As all *Quadratick Equations* may be, by the 84th and 85th Propoſitions of the ſame *Data*.

Lateral EQUATION, [in *Algebra*,] an Equation having only one Root; whereas a Quadratick two, and a Cubick three Roots, &c. And ſuch Equations can be determined and conſtructed by the interſection of two right Lines, which is a Compoſition of 1 + 1 = 2; but a Quadratick cannot be determined or conſtructed without a ſtrait Line, and a Circle cutting each other.

Of the Rules by which Problems are ſolved.

The Reduction of an Equation is the ſeparating of one Quantity from the reſt, ſo that it alone ſhall be found on one ſide of the Equation, in which Caſe the Value of it expreſſed by other

Quantities is neceſſarily contained on the other ſide of the Equation.

It is to be obſerved, that the Equality in an Equation is not deſtroyed, if all the Members are multiplied or divided by the ſame Quantity, alſo if the ſame Quantity, if added to, or ſuſtracted from each ſide of the Equation, the Equality will ſtill remain; whence it follows, that any Quantity may be tranſpos'd from one ſide of an Equation to the other, and the Equality will ſtill remain by changing the Sum of the Quantity tranſpos'd.

Rule I.

When there is an Intermixture of Quantities known and unknown in any Equation, let all the known Quantities (by tranſpoſition) be made to poſſeſs only one ſide of the Equation, and all the unknown Quantities the other ſide of the Equation.

Tranſpoſition is always done by carrying the Quantity to be tranſpoſed to the other ſide of the Sign of Equality with a contrary Sign it had before; that is, if it had an affirmative Sign on one ſide of the Equation, it will have a negative Sign when carried to the other ſide of the Equation.

Thus,

$2x+10=x+25$
$2x-x=25-10$
$x=15$

$12y+12=11y+25$
$12y-11y=25-12$
$y=13$

Alſo,

$8x-10=7x+15$
$8x-7x=15+10$
$x=25$

$20z+50=19z+150$
$20z-19z=150-50$
$z=100$

When the unknown Quantity is multiplied (*viz.* join'd) with any that is known, let the whole Equation be divided by the known Quantity that multiplies the unknown, that ſo the unknown Quantity may ſtand by itſelf.

Thus,

$10x-4=6x+24$
$10x-6x=24+4$
$4x=28$
$x=\frac{28}{4}=7$

$20y+90=300-10y$
$20y+10y=300-90$
$30y=210$
$y=\frac{210}{30}=7$

Alſo

$15z+124=500-5z$
$15z+5z=500-124$
$20z=376$
$z=\frac{376}{20}=18\frac{16}{20}$

$12x-13=20+4x$
$12x-4x=20+13$
$8x=33$
$x=\frac{33}{8}=4\frac{1}{8}$

If the Quantity whoſe Value is required be the Numerator of a Fraction the whole Equation muſt be multiplied by the Denominator of that Fraction, which may alſo be applied to any Number of Fractions.

Thus,

$\frac{5x}{7}+10=20-x$
$5x+70=140-7x$
$5x+7x=140-70$
$12x=70$
$x=\frac{70}{12}=5\frac{10}{12}$

$\frac{20y}{4}-12=100+4y$
$20y-48=400+16y$
$20y-16y=400+48$
$4y=448$
$y=\frac{448}{4}=112$

Alſo,

$\frac{5x}{3}-10=\frac{5x}{6}+4$
$5x-30=\frac{15x}{6}+12$
$30x-180=15x+72$
$30x-15x=180+72$
$15x=252$
$x=\frac{252}{15}=16\frac{12}{15}$

$\frac{15y}{4}+12=\frac{10y}{7}+100$
$15y+48=\frac{40y}{7}+400$
$105y+336=40y+2800$
$105y-40y=2800-336$
$65y=2464$
$y=\frac{2464}{65}=37\frac{59}{65}$

When any Quantity (either known or unknown) is multiplied into every Term of an Equation, if the whole Equation be divided by that Quantity, the Equation will thereby be reduced to lower Terms.

Thus,

$bx+bc=bcd$
$x+c=cd$
$x=cd-c$

$4y^2-14y=20y$
$4y-14=20$
$4y=20+14$
$y=\frac{34}{4}=8\frac{1}{2}$

$cyy-cy=dy$
$cy-c=d$
$cy=d+c$
$y=\frac{d+c}{c}$

$dx^3+2dx^2=10ax^2$
$dx+2d=10a$
$dx=10a-2d$
$x=\frac{10a-2d}{d}$

If the Quantity, whoſe Value is requir'd, be involved with the radical Sign; that is firſt to be taken away, by ſeparating according to the preceding Rules, the Quantity thus involv'd from the reſt, ſo that it may be alone on one ſide of the Equation; and that ſide of the Equation which is not affected with the Surd Root, muſt be once multiplied into it ſelf, (if the Sign denote that the ſquare Root was to be extracted) or it muſt twice be multiplied into it ſelf, if the Root be a Cubick one, &c. And then take away the radical Sign, and the Equality will ſtill remain, as in the following Examples.

$\sqrt{x-4}=12$
$x-4=144$
$x=144+4=148$

$\sqrt{\frac{4x}{3}+4}-14=100$
$\sqrt{\frac{4x}{3}+4}=114$
$\frac{4x}{3}+4=12996$
$4x+12=38988$
$4x=38988-12$
$x=\frac{38976}{4}=9744$

If

$\sqrt[3]{y-a}=a-c$
$y-a=a^3-3a^2c+3ac^2-c^3$
$y=a^3-3a^2c+3ac^2-c^3+a$

And if

$\sqrt[4]{y}=5$
$y=5\times5\times5\times5=625$

If the ſide of the Equation which contains the unknown Quantity be a compleat Square, or Cube, then extract the Square or Cube Root, of both ſides of the Equation, and the Equation by that Extraction ſhall be reduced to an Equation of a lower Degree.

Thus,

$x^2+6=150$
$x^2=144$
$x=12$

$y^3=125$
$y=5$

Alſo, if

$$\begin{array}{ll} x^3 = ac + ad & x^4 + 5 = 630 \\ x = \sqrt[3]{ac + ad} & x^4 = 630 - 5 \\ & x = \sqrt[4]{625} \end{array}$$

A Proportion may be turned into an Equation, making the Product of the Extreams, *viz.* the firſt and laſt Terms, equal to the Product of the Means: Thus:

As

$$\begin{array}{ll} 4 : 20 :: 6 : x & 5 : 30 :: 15 : y \\ 4x = 120 & 5y = 450 \\ x = \frac{120}{4} = 30 & y = \frac{450}{5} = 90 \end{array}$$

Alſo, as

$$\begin{array}{ll} 5b+2c : c+b :: c+b : x & ba+3b : a+d :: a+b : x \\ 5bx+2cx = c^2+2cb+b^2 & bax+3bx = a^2+ad+ab+bd \\ x = \frac{c^2+2cb+b^2}{5b+2c} & x = \frac{a^2+ad+ab+bd}{ba+3b} \end{array}$$

If ſome Power of the unknown Quantity be affected with the Radical Sign, then the Root of this Power is to be extracted from both Sides of the Equation; the unknown Quantity and its coefficients being firſt made to poſſeſs wholly one ſide of the Equation: Thus,

$$d + \frac{\sqrt{ayy+byy+c^3}}{\sqrt{c}} = b$$

$$\frac{\sqrt{ayy+byy+c^3}}{\sqrt{c}} = b - d$$

$$\frac{ayy+byy+c^3}{c} = b^2 - 2bd + dd$$

$$ayy+byy+c^3 = cb^2 - 2bdc + ddc$$

$$ayy+byy = cb^2 - 2bdc + ddc - c^3$$

$$yy = \frac{cb^2 - 2bdc + ddc - c_3}{a+b}$$

$$y = \sqrt{\frac{cb^2 - 2bdc + ddc - c^3}{a+b}}$$

Of the Reduction of ſeveral Equations to one.

Two Equations are reduced to one, by taking away one unknown Quantity, which is done by ſeperating the Quantity; ſo in one Equation, by the preceding Rules, that it may be found alone in one Member, and then ſubſtituting its Value in the other Equation.

Let there be two Equations.

$$\begin{array}{ll} \left.\begin{array}{l} ax+dy=fg \\ afx+d^2x=a^2y \end{array}\right\} \text{required } x \text{ and } y & \left.\begin{array}{l} ax+ay=cb-cy \\ ax+cx=ddy \end{array}\right\} \\ y = \frac{fg-ax}{d} & ax+ay+cy=cb \\ afx+d^2x = \frac{a^2fg-a^3x}{d} & ay+cy=cb-ax \\ afdx+d^3x = a^2fg-a^3x & y = \frac{cb-ax}{a+c} \\ afdx+d^3x+a^3x = a^2fg & \\ x = \frac{a^2fg}{afd+d^3+a^3} & \end{array}$$

Then in the ſecond Equation, inſtead of y ſubſtitute its Value, and this Equation will ariſe

$$ax+cx = \frac{d^2cb - d^2ax}{a+c}$$

$$a^2x+acx+cax+ccx = ddcb - ddax$$

$$aax+acx+cax+ccx+ddax = ddcb$$

$$x = \frac{ddcb}{aa+2ac+cc+ada}$$

In two Equations a Quantity may alſo be taken away, by finding its Value in each Equation, by the preceding Rules; and if thoſe Values be not of the ſame Degree (or Power) raiſe the loweſt Power to that of the higheſt; and then by making of thoſe Values equal to the other: Thus,

$$\begin{array}{ll} \left.\begin{array}{l} x+y=a \\ x-y=b \end{array}\right\} & \left.\begin{array}{l} a+x=b+y \\ 2x+y=3b-4x \end{array}\right\} \\ x=a-y & y=a+x-b \\ x=b+y & y=3b-4x-2x \\ a-y=b+y & a+x-b=3b-4x-2x \\ a-y-b=y & a+7x=4b \\ a-b=y+y & 7x=4b-a \\ y=\frac{a-b}{2} & x=\frac{4b-a}{7} \end{array}$$

When there are given many Equations, in each of which there are unknown Quantities, one Quantity may be taken away, by ſeeking the Value of the ſame Quantity in all the Equations in which it is found, and comparing thoſe Values together: Thus, by diminiſhing continually the remaining Equations by this Method, we ſhall at laſt come to one Equation, wherein there will be but one unknown Quantity: Thus,

$$\begin{array}{ll} \left.\begin{array}{l} x+y+z=a \\ x+y+u=b \\ x+z+u=c \\ x-z-u=d \end{array}\right\} \textit{Data} & \left.\begin{array}{l} x-y-z=a \\ x-y-u=b \\ x-z-u=c \\ y-z-u=d \end{array}\right\} \\ x=a-y-z & x=a+y+z \\ x=b-y-u & a+y+z-y-u=b \\ a-y-z=b-y-u & a+y+z-z-u=c \\ x=a-b+u & y-z-u=d \\ x=c-z-u & y=c-a+u \\ x=d+z+u & c-a+u-z-u=d \\ c-z-u=d+z+u & a+z-u=b \\ 2z=c-d-2u & z=c-a-d \\ z=\frac{c-d-2u}{2} & a+c-a-d-u=b \\ \frac{c-d-2u}{2}=a-b+u & u=c-d-b \\ c-d-2u=2a-2b+2u & \\ 4u=c-d-2a+2b & \\ u=\frac{c-d-2a+2b}{4} & \end{array}$$

When the Quantity to be (exterminated) taken away is of more than one Dimenſion, in both the Equations, the Value of its greateſt Power muſt be ſought in both the Equations; and if thoſe Powers are both the ſame, if the Equations be made equal to one another, the higheſt Power will vaniſh; but if thoſe Powers are not the ſame, the Equation that contains the leſſer Power muſt be multiplied by the Quantity to be taken away; or by its Square or Cube, &c. that it may become of the ſame Power of the other Equation; then the Value of thoſe Powers are to be made equal, and there will come out a new Equation where the greateſt Power or Dimenſion of the Quantity taken away is diminiſhed; and by repeating this Operation, the Quantity will at length be taken away.

Thus,

$$\begin{array}{ll} \left.\begin{array}{l} x^2+12x=4a \\ 2xy-4x^2=b \end{array}\right\} \textit{Data} & \left.\begin{array}{l} y^3+5y=a \\ y^3-\frac{10y}{4}=b \end{array}\right\} \\ x^2=4a-12x & y^3=a-5y \\ x^2=\frac{2xy-b}{4} & y^3=b+\frac{10y}{4} \end{array}$$

$$4a-12x=\frac{2xy-b}{4}$$
$$16a-48x=2xy-b$$
$$16a+b=2xy+48x$$
$$x=\frac{16a+b}{2y+48}$$

$$a-5y=b+\frac{10y}{4}$$
$$4a-20y=4b+10y$$
$$4a-4b=10y+20y$$
$$y=\frac{4a-4b}{30}$$

A Son ask'd his Father how old he was? his Father anſwer'd him thus, If you take away 5 from my Years, and divide the remainder by 8, the Quotient will be ⅓ of your Age; but if you add 2 to your Age, and multiply the whole by 3, and then ſubſtract 7 from the Product, you will have the number of the Years of my Age. What was the Age of the Father and Son?

Let $x=$ the Age of the Father,
And $y=$ the Age of the Son,
Then,

$$\frac{x-5}{8}=\tfrac{1}{3}y$$
$$y+2\times3-7=x$$
$$3x-15=8y$$
$$x=\frac{8y+15}{3}$$
$$x=3y+6-7$$
$$\frac{8y+15}{3}=3y+6-7$$
$$8y+15=9y+18-21$$
$$y=15+21-18=18$$
$$y=\frac{x-6+7}{3}$$
$$y=\frac{3x-15}{8}$$
$$\frac{x-6+7}{3}=\frac{3x-15}{8}$$
$$8x-48+56=9x-45$$
$$x=56+45-48=53$$

To find out two Numbers, to the Sum whereof if you add 6, the whole ſhall be double the greater; and if you ſubſtract 2 from their Difference, the Remainder will be half of the leaſt.

$$\text{Let}\begin{cases}x=\text{the greater,}\\ y=\text{the leſſer,}\end{cases}$$

Then,

$$x+y+6=2x$$
$$x-y-2=\frac{y}{2}$$
$$2x-2y-4=y$$
$$x=\frac{3y+4}{2}$$
$$x=y+6$$
$$y+6=\frac{3y+4}{2}$$
$$2y+12=3y+4$$
$$y=12-4=8$$
$$y=x-6$$
$$y=\frac{2x-4}{3}$$
$$x-6=\frac{2x-4}{3}$$
$$3x-18=2-4$$
$$x=18-4=14$$

Suppoſe the Number 50 were to be divided into two Parts, ſo that the greater Part being divided by 7, and the leſſer multiplied by 3, the Sum of this Product and the former Quotient, may make the ſame Number propos'd, which was 50.

$$x+y=50$$
$$\frac{x}{7}+3y=50$$
$$x=50-y$$
$$\frac{50-y}{7}+3y=50$$
$$50-y+21y=350$$
$$20y=350-50$$
$$y=\frac{300}{20}=15$$
$$x=50-y=35$$

To find 3 Numbers, ſo that the firſt and half of the Remainder, the ſecond and ⅓ of the Remainder, and the third and ¼ of the Remainder, may always make 34.

$$\text{Let}\left.\begin{matrix}x\\ y\\ z\end{matrix}\right\}=\text{the three Numbers ſought,}$$

Then,

$$x+\frac{y+z}{2}=34$$
$$y+\frac{x+z}{3}=34$$
$$z+\frac{x+y}{4}=34$$
$$2x+y+z=68$$
$$3y+x+z=102$$
$$4z+x+y=136$$
$$x=\frac{68-y-z}{2}$$
$$3y+\frac{68-y-z}{2}+z=102$$
$$4z+\frac{68-y-z}{2}+y=136$$
$$6y+68-y-z+2z=204$$
$$8z+68-y-z+2y=272$$
$$y=\frac{136-z}{5}$$
$$8z+68-z+\frac{136-z}{5}=272$$
$$40z+340-5z+136-z=1360$$
$$34z=884$$
$$z=\frac{884}{34}=26$$
$$7z+68+y=272$$
$$7z=272-68-y$$
$$z=\frac{204-y}{7}$$
$$6y+68-y+\frac{204-y}{7}=204$$
$$35y+476+204-y=1428$$
$$34y=1428-476-204$$
$$y=\frac{748}{34}=22$$
$$x=\frac{68-y-z}{2}=10$$

To find two Numbers, the Sum of whoſe Squares may be 317, and the Product, if they be multiply'd by one another, 154.

Let $\left\{\begin{array}{l} x = \text{the greater,} \\ y = \text{the leſſer,} \end{array}\right.$

Then,

$$x^2+y^2=317=a$$
$$xy=154=b$$
$$x=\frac{b}{y}$$
$$\frac{b^2}{y^2}+y^2=a$$
$$b^2+y^4=ay^2$$
$$y^4-ay^2=-b^2$$
$$y^4-ay^2+\frac{aa}{4}=\frac{aa}{4}-b^2$$
$$y^2-\frac{a}{2}=\sqrt{\frac{aa}{4}-b^2}$$
$$y^2=\frac{a}{2}+\sqrt{\frac{aa}{4}-b^2}$$
$$y=\sqrt{\frac{a}{2}+\sqrt{\frac{aa}{4}-b^2}}=11$$
$$y=\frac{b}{x}$$
$$x^2+\frac{bb}{xx}=a$$
$$x^4+bb=ax^2$$
$$x^4-ax^2=-bb$$
$$x^4-ax^2+\frac{aa}{4}=\frac{aa}{4}-bb$$
$$x^2-\frac{a}{2}=\sqrt{\frac{aa}{4}-bb}$$
$$x^2=\frac{a}{2}+\sqrt{\frac{aa}{4}-bb}$$
$$x=\sqrt{\frac{a}{2}+\sqrt{\frac{aa}{4}-bb}}=14$$

To find two Numbers, the Product of which may be 108, and the difference of the Squares 63.

Let $\left.\begin{array}{l} x = \text{the greater,} \\ y = \text{the leſſer,} \end{array}\right\}$ and $\left\{\begin{array}{l} a = 108 \\ b = 63 \end{array}\right.$

Then,

$$xy=a$$
$$x^2-y^2=b$$
$$x=\frac{a}{y}$$
$$\frac{a^2}{y^2}-y^2=b$$
$$a^2-y^4=by^2$$
$$y^4+by^2=a^2$$
$$y^4+by^2+\frac{bb}{4}=a^2+\frac{bb}{4}$$
$$y^2+\frac{b}{2}=\sqrt{a^2+\frac{bb}{4}}$$
$$y=\sqrt{\sqrt{a^2+\frac{bb}{4}}-\frac{b}{2}}=9$$
$$y=\frac{a}{x}$$
$$x^2-\frac{a^2}{x^2}=b$$
$$x^4-a^2=bx^2$$
$$x^4-bx^2=a^2$$
$$x^4-bx^2+\frac{bb}{4}=a^2+\frac{bb}{4}$$
$$x^2-\frac{b}{2}=\sqrt{a^2+\frac{bb}{4}}$$
$$x^2=\frac{b}{2}+\sqrt{a^2+\frac{bb}{4}}$$
$$x=\sqrt{\frac{b}{2}+\sqrt{a^2+\frac{bb}{4}}}=12$$

Two Companies of Workmen, whoſe Difference is 40, have diſtributed among each Company 1200 Pence, whereby it happen'd that the Workmen of the leſſer Company had 5 Pence a piece, more than thoſe of the greater, the Queſtion is, to find the Number of Workmen in each Company.

Let $\left\{\begin{array}{l} x = \text{greater Company} \\ y = \text{leſſer.} \end{array}\right\} \left\{\begin{array}{l} a = 40 \\ c = 1200 \\ d = 5 \end{array}\right.$

Then,

$$x-y=a$$
$$\frac{c}{x}+d=\frac{c}{y}$$
$$x=a+y$$
$$\frac{c}{a+y}+d=\frac{c}{y}$$
$$c+da+dy=\frac{ca+cy}{y}$$
$$cy+day+dyy=ca+cy$$
$$dy^2+day=ca$$
$$y^2+ay=\frac{ca}{d}$$
$$y^2+ay+\frac{aa}{4}=\frac{ca}{d}+\frac{aa}{4}$$
$$y+\frac{a}{2}=\sqrt{\frac{ca}{d}+\frac{aa}{4}}$$
$$y=\sqrt{\frac{ca}{d}+\frac{aa}{4}}-\frac{a}{2}=80$$
$$x=a+y=120$$

Let 600 Soldiers be diſpoſed into an oblong Battle, which the Colonel willing to make broader, finds that if he takes away 10 Ranks from the Length, he ſhall augment the Breadth with 2 Ranks, what was the Number of his Soldiers, through every Rank, in Length and Breadth.

Let $x =$ the Length,
$y =$ the Number of Men in Breadth,

Then,

$$\left.\begin{array}{l} x-10 \\ y+\ 2 \end{array}\right\} \text{Multiply}$$

$$\text{Product}=xy+2x-10y-20=600=a\}\ \textit{Data}$$
$$xy=600=a$$
$$x=\frac{a}{y}$$
$$x=\frac{a+10y+20}{y+2}$$
$$\frac{a}{y}=\frac{a+10y+20}{y+2}$$
$$ay+2a=ay+10y^2+20y$$
$$y^2+2y=\frac{2a}{10}$$

$$y^2+2y+1=\frac{2a}{10}+1$$

$$y+1=\sqrt{\frac{2a}{10}+1}$$

$$y=\sqrt{\frac{2a}{10}+1}-1=10$$

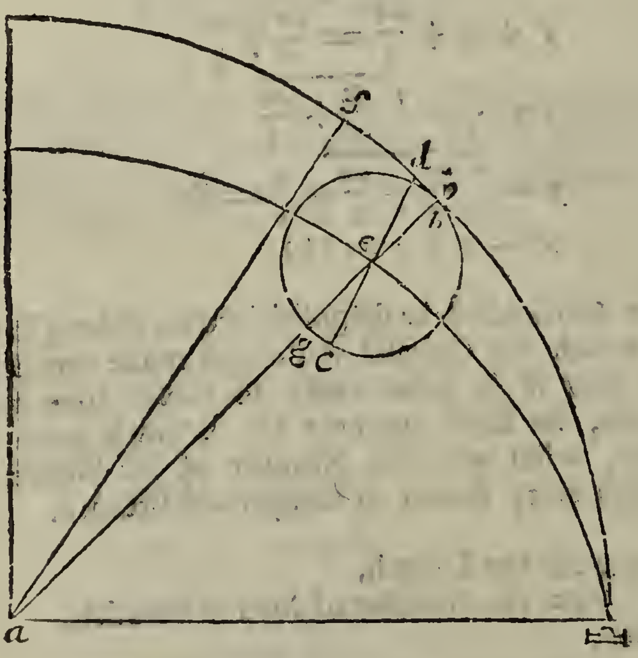
$$x=\frac{a}{y}=60$$

EQUATION *(Annual)* of the mean Motion of the Sun and Moon, and of the Moon's *Apogee* and *Nodes*.

The *Annual Equation* of the mean Motion of the Sun, depends upon the Eccentricity of the Earth's Orbit round him; and is $16\frac{1}{2}$ ſuch Parts, of which the mean diſtance between the Sun and the Earth is 1000: from whence, by ſome, 'tis called the *Equation of the Center*; and this, when greateſt, 1 Deg. 56′. 20″. the greateſt *Annual*.

Equation of the Moon's mean Motion is 11′. 40″. of its *Apogee* 20′. and of its *Node* 9′. 30″. And theſe four annual Equations are always mutually proportionable to one another; ſo that when any of them is at the greateſt, the three others alſo will be greateſt; and when any one leſs, the reſt diminiſh in the ſame Ratio: Wherefore, the *Annual Equation* of the Center (of the Sun) being given, the other three correſponding *Equations* will be given; ſo that one Table *(i. e.* of the *Central Equation)* may ſerve for all.

EQUATION *of Time*, or *of Natural Days*, in *Aſtronomy*, as the Noble *Tycho* hath aſſerted, and our Famous Mr. *Street* demonſtrated, is the Difference between the Sun's true Longitude, and his right Aſcenſion.



Let the Center of the Sun be ſuppoſed at *a*, and of the Earth at *e*: Let ♎ *e* repreſent the Earth's Longitude in the Ecliptick, and ♎ the like Arch projected into the Equator: Let ♎ *b* be the Earth's (or Sun's) right Aſcenſion in its true Place; *g b* is a Diameter of the Equinoctial, and Meridian of the Earth's apparent diurnal Revolution; *a b* is the Semidiameter of the true Meridian and Equinoctial ſuppoſed in the Heavens; and *g h* is ſuppoſed to be parallel to *a b*, tho' they appear here but as one Line. Let *c d* be drawn parallel to *a f*, and be alſo a Diameter of the Equinoctial and Meridian of the mean or equal Revolution. It will then be plain, that *c e g*, which is the Angle of the Earth's Libration, muſt be equal to *b a f*, the Difference of Longitude and right Aſcenſion; and conſequently muſt be the true Equation of Time, or the Difference between the *equal* and *apparent* Time.

Dr. *Wallis* thus accounts for the inequality of Natural Days.

The Natural Day is meaſured not only by one entire Converſion of the *Equinoctial* or 24 *Equinoctial* Hours, (which is indeed taken to be performed in equal times) but increaſes by ſo much, as anſwers to that part of the *Sun's* (or *Earth's* annual Motion) as is performed in that Time. For when that part of the *Equinoctial*, which (with the Sun) was at the Meridian Yeſterday at Noon, is come thither again to Day: It is not yet Noon, (becauſe the Sun is not now at the Place where Yeſterday he was, but is gone forward about one Degree more or leſs) but we muſt ſtay till that Place where the Sun now is, comes to the Meridian, before it be now Noon.

This Additament (above the 24 *Equinoctial Hours*, or entire Converſion of the *Equinoctial)* is upon a double Account unequal.

Firſt, Becauſe the Sun, by reaſon of its *Apogæum* and *Perigæum*, doth not at all Times of the Year, diſpatch in one Day an equal Arch of the *Ecliptick*; but greater Arches near the *Perigæum*, which is about the middle of *December*; and leſſer near the *Apogæum*, which is about the middle of *June*; as will appear ſufficiently by the Tables of the Sun's annual Motion.

Secondly, Though the Sun ſhould in the *Ecliptick* move always at the ſame rate, yet equal Arches of the *Ecliptick*, do not in all parts of the *Zodiack* anſwer to equal Arches of the *Equinoctial*; by which we are to eſtimate Time; becauſe ſome parts of it, as the two Solſtitial Points, lie nearer to a parallel Poſition to the *Equinoctial* than others; as theſe about the two *Equinoctial* Points, where the *Ecliptick* and *Equinoctial* do interſect: Whereupon an Arch of the *Ecliptick* near the Solſtitial Points, anſwers to a greater Arch of the *Equinoctial*, than an Arch equal thereto near the *Equinoctial* Points; as doth ſufficiently appear by the Table of the Sun's right Aſcenſion.

If you imagine another Sun to move in the Heavens in an equal Emotion, not in the *Ecliptick*, but in the *Equinoctial*; the difference between their coming to the Meridian every Day, (or to any one and the ſame Hour-circle) will be the *Equation of Time*. And becauſe the true Sun, and that Point of the Equator where his right Aſcenſion ends, come always to the Meridian together; the *Equation of Time* may be defined to be that Space of Time which is paſſed over, while an Arch of the Equator, comprehended between the extreme Point of the true Sun's Aſcenſion, and the Place of the feigned Sun, paſſes over the Meridian: And if this Arch be turned into Time, it gives the true *Equation of Time*. Dr. *Greg. Aſtron.*

Mr. Flamſtead's *Tables of* Equation of Natural Days.

Leap-Year.

	Jan.		*Febru.*		*March.*		*April.*		*May.*		*June.*		*July.*		*Auguſt.*		*Septem.*		*Octob.*		*Novem.*		*Decem.*	
	M.	S.	M	S.	M.	S.	M.	S.	M.	S.	M.	S.	M.	S.	M.	S.	M.	S.	M.	S.	M.	S.	M.	S.
1	8	47	14	49	10	00	0	41	4	10	0	59	4	47	4	26	3	58	13	22	15	19	5	28
2	9	10	14	48	9	45	0	24	4	11	0	47	4	55	4	16	4	19	13	36	15	10	4	59
3	9	32	14	46	9	26	0*	8	4	12	0	34	5	2	4 Watch	5	4	39	13	49	15	01	4 too ſlow	31
4	9	54	14	43	9	9	0*	7	4	13	0	22	5	9	3	54	5	0	14	2	14	50	4	2
5	10	15	14	40	8	51	0	22	4	12	0*	10	5	15	3	43	5	20	14	14	14	38	3	33
6	10	36	14	36	8	33	0	37	4	10	0*	3	5	20	3	31	5	41	14	26	14	26	3	3
7	10	55	14	31	8	15	0	52	4	10	0	16	5	25	3	18	6	1	14	37	14	13	2	33
8	11 Watch	14	14 Watch	26	7 Watch	57	1 Watch	6	4 Watch	8	0 Watch	29	5 Watch	30	3 too faſt	5	6 Watch	22	14 Watch	47	14 Watch	00	2	3
9	11	32	14	20	7	39	1	19	4	5	0	42	5	34	2	53	6	43	14	57	13	45	1	33
10	11	49	14	13	7	20	1	31	4	2	0	55	5	37	2	38	7	3	15	6	13	30	1	4
11	12	5	14	5	7	1	1	47	3	59	1	7	5	40	2	24	7	24	15	15	13	13	0	34
12	12	22	13	57	6	43	1	57	3	54	1	20	5	43	2	9	7	44	15	24	12	56	0	4
13	12 too faſt	37	13 too faſt	48	6 too faſt	24	2 too ſlow	9	3 too ſlow	50	1 too faſt	33	5 too faſt	45	1	54	8 too ſlow	4	15 too ſlow	30	12 too ſlow	38	0*	26
14	12	51	13	39	6	5	2	19	3	45	1	46	5	45	1	38	8	24	15	36	12	19	0*	56
15	13	5	13	29	5	46	2	30	3	39	1	59	5	46	1	22	8	43	15	42	2	00	1	26
16	13	18	13	18	5	27	2	41	3	33	2	11	5	46	1	5	9	3	15	47	11	40	1	56
17	13	30	13	7	5	9	2	51	3	26	2	22	5	45	0	48	9	23	15	51	11	20	2	25
18	13	41	12	56	4	50	3	0	3	19	2	35	5	44	0*	31	9	42	15	54	10	59	2 Watch	34
19	13	51	12	44	4	31	3	8	3	11	2	41	5	42	0*	13	10	2	15	57	10	37	3	23
20	14	0	12	32	4	13	3	16	3	3	2	59	5	40	0	5	10	21	15	59	10	14	3	52
21	14	9	12	18	3	54	3	24	2	54	3	10	5	37	0	22	10	39	16	00	9	50	4	21
22	14	17	12	5	3	36	3	32	2	46	3	22	5	33	0	40	10	57	16	01	9	26	4	40
23	14	24	11	51	3	17	3	39	2	37	3	33	5	29	0 too ſlow	59	11	15	16	00	9	2	5 too faſt	16
24	14	39	11	36	2	59	3	45	2	27	3	44	5	25	1	19	11	32	15	59	8	37	5	43
25	14	35	11	21	2	40	3	50	2	17	3	54	5	19	1	39	11	49	15	56	8	11	6	11
26	14	39	11	5	2	22	3	54	2	6	4	4	5	13	1	58	12	6	15	54	7	45	6	37
27	14	43	10	50	2	5	3	58	1	56	4	13	5	7	2	17	12	22	15	50	7	19	7	3
28	14	46	10	34	1	47	4	2	1	45	4	22	5	0	2	37	12	37	15	46	6	52	7	29
29	14	47	10	17	1	13	4	5	1	34	4	31	4	52	2	57	12	53	15	40	6	24	7	54
30	14	49					4	8	1	22	4	39	4	44	3	18	13	8	15	34	5	57	8	18
31	14	49			2	57			1	11			4	35	3	38			15	27			8	41

The Firſt after Leap-Year.

	Jan.		*Februa.*		*March.*		*April.*		*May*		*June.*		*July.*		*Auguſt.*		*Septem.*		*October.*		*Novem.*		*Decem.*	
	M.	S.	M.	S.	M.	S.	M.	S.	M.	S.	M.	S.	M	S.	M.	S.	M.	S.	M.	S.	M.	S.	M.	S
1	9	4	14	48	10	4	0	45	4	10	1	0	4	45	4	28	3	53	13	18	15	2	5	33
2	9	26	14	46	9	47	0	28	4	11	0	50	4	53	4	18	4	14	3	32	15	15	5	6
3	9	48	14	44	9	30	0*	12	4	12	0	37	5	0	4 Watch	8	4	34	13	46	15	3	4 too ſlow	38
4	10	10	14	41	9	13	0*	3	4	12	0	25	5	7	3	57	4	55	13	59	14	53	4	9
5	10	31	14	37	8	55	0	18	3	12	0*	13	5	13	3	46	5	1	14	11	14	41	3	4
6	10	50	14	32	8	37	0	33	4	11	0*	0	5	18	3	34	5	36	14	23	14	29	3	10
7	11	9	14	27	8	19	0	48	4	10	0	13	5	24	3	21	5	56	4	34	14	7	2	40
8	11 Watch	27	14 Watch	21	8 Watch	1	1 Watch	2	4 Watch	8	0	26	4 Watch	29	3 too faſt	8	6 Watch	17	14 Watch	44	14 Watch	3	2	10
9	11	43	14	15	7	43	1	6	4	8	0	39	5	33	2	55	6	38	14	54	13	49	1	4
10	12	2	14	7	7	2	1	28	4	3	0	52	5	36	2	41	6	58	5	4	13	34	1	11
11	12	18	13	59	7	6	1	41	4	0	1	4	5	39	2	27	7	10	15	13	13	17	0	41
12	12	34	13	50	6	47	1	54	3	56	1	17	5	42	2	13	7	39	15	22	13	0	0	21
13	12 too faſt	47	13 too faſt	41	6 too faſt	28	2 too ſlow	6	3 too ſlow	51	1 Watch	30	5 too faſt	44	1	58	7 too ſlow	59	15 too ſlow	28	12 too ſlow	43	0*	19
14	13	2	13	31	6	10	2	16	3	46	1	43	5	45	1	42	8	19	15	34	12	24	0*	49
15	13	15	13	21	5	51	2	27	3	40	1	56	5	46	1	26	8	38	15	40	12	5	1	19
16	13	27	13	10	5	37	2	38	3	4	2	8	5	46	1	9	8	58	15	45	11	45	1	49
17	13	38	12	59	5	14	2	48	3	28	2	20	5	45	0	5	9	18	15	50	11	25	2	18
18	13	48	12	41	4	55	2	57	3	21	2 too faſt	32	5	44	0*	35	9	3	15	53	11	4	2 Watch	47
19	13	58	12	35	4	36	3	6	3	13	2	44	5	42	0*	17	9	57	15	56	10	42	3	26
20	14	7	12	22	4	17	3	14	3	5	2	56	5	40	0	1	10	16	15	58	10	20	3	45
21	14	15	12	8	3	50	3	22	2	56	3	7	5	38	0	18	10	34	5	59	9	50	4	14
22	14	22	11	54	3	42	3	30	2	48	3	19	5	34	0	36	10	5	16	0	9	32	4	42
23	14	28	11	40	3	2	3	37	2	3	3	30	5	30	0 too ſlow	55	11	10	16	1	9	8	5 too faſt	9
24	14	34	11	24	3	3	3	33	2	28	3	41	5	2	1	14	11	28	15	50	8	43	5	36
25	14	33	11	0	2	45	3	40	2	19	2	51	5	20	1	34	11	45	15	5	8	17	6	4
26	14	42	10	54	2	26	3	53	2	9	4	1	5	14	1	53	12	2	15	55	7	51	6	30
27	4	45	10	38	2	9	3	57	1	59	4	11	5	8	2	12	12	18	15	51	7	25	6	57
28	14	47	10	21	1	51	4	1	1	48	4	20	5	2	2	32	12	33	15	47	6	59	7	33
29	14	48			1	34	4	4	1	37	4	29	4	54	2	52	12	49	15	41	6	31	7	48
30	14	40			1	17	4	7	1	25	4	37	4	46	3	43	13	4	15	35	6	3	8	12
31	14	40			1	01			1	14				37	3	32			15	20			8	25

The Second after Leap. Year.

	Janua.			Februa.			March			April.			May.			June.		
	M		S	M		S.	M.		S	M.		S.	M.		S	M.		S
1	8		59	14		48	10		8	0		49	4		9	1		5
2	9		21	14		47	9		55	0		32	4		11	0		53
3	9		43	14		45	9		34	0*		16	4		12	0		40
4	10		5	14		42	9		17	0*		1	4		13	0		28
5	10		26	14		38	8		53	0		14	4		12	0		16
6	10		45	14		33	8		41	0		29	4		11	0		3
7	11		5	14		28	8		24	0		44	4		10	0*		10
8	11	Watch	24	14	Watch	23	8	Watch	5	0		58	4	Watch	8	0*		23
9	11		40	14		14	7		47	1		12	4		6	0		36
10	11		57	14		9	7		29	1		26	4		4	0		49
11	12		14	14		[illegible]	7		10	1		38	4		1	1		1
12	12		30	13		52	6		52	1		51	3		57	1		14
13	12	too faſt	44	13	too faſt	43	6	too faſt	33	2	Watch	3	3	too ſlow	52	1	Watch	27
14	12		58	13		34	6		15	2		14	3		47	1		40
15	13		12	13		4	5		50	2		4	3		41	1		53
16	13		24	13		13	5		37	2		35	3		35	2		5
17	13		35	13		2	5		18	2		46	3		29	2		17
18	13		46	12		50	5		0	2	too ſlow	56	3		23	2	too faſt	29
19	13		56	12		37	4		24	3		4	3		15	2		41
20	14		5	12		25	4		25	3		12	3		7	2		53
21	14		13	12		12	4		3	3		20	2		58	3		4
22	14		20	11		57	3		44	3		28	2		50	3		16
23	14		27	11		45	3		26	3		35	2		41	3		27
24	14		32	11		28	3		8	3		42	2		31	3		38
25	14		37	11		13	2		49	3		47	2		21	3		48
26	14		41	10		58	2		31	3		52	2		11	3		59
27	14		44	10		42	2		13	3		56	2		1	4		9
28	14		47	10		25	1		55	4		0	1		51	4		18
29	14		48				1		38	4		3	1		40	4		27
30	14		49				1		22	4		6	1		28	4		35
31	14		49				1		5				1		17			

	July			Auguſt			Septem			October			Novem.			Decem.		
	M.		S.	M.		S	M.		S.	M.		S	M.		S.	M.		S
1	4		43	4		30	3		48	13		14	15		23	5		42
2	4		51	4		20	4		9	13		28	15		15	5		13
3	4		58	4	Watch	10	4		29	13		42	15		5	4	too ſlow	45
4	5		5	4		0	4		50	13		56	14		55	4		16
5	5		11	3		49	5		10	14		8	14		44	3		47
6	5		14	3		37	5		31	14		20	14		32	3		17
7	5		23	3		24	5		51	14		31	14		20	2		47
8	5	Watch	28	3	too faſt	11	6	Watch	12	14	Watch	41	14	Watch	6	2		17
9	5		32	2		58	6		33	14		51	13		52	1		47
10	5		35	2		44	6		53	15		1	13		38	1		18
11	5		38	2		30	7		14	15		11	13		21	0		38
12	5		41	2		16	7		34	15		20	13		4	0*		18
13	5	too faſt	43	2		2	7	too ſlow	54	15	too ſlow	26	12	too ſlow	47	0*		12
14	5		45	1		16	8		14	15		32	12		28	0		42
15	5		46	1		30	8		33	15		38	12		9	1		12
16	5		46	1		13	8		53	15		44	11		50	1		42
17	5		45	0		56	9		13	15		49	11		30	2		11
18	5		44	0		39	9		32	15		52	11		9	2	Watch	40
19	5		42	0		21	9		50	15		55	10		47	3		0
20	5		40	0*		3	10		11	15		57	10		25	3		38
21	5		38	0*		14	10		30	15		59	10		2	4		7
22	5		35	0		31	10		48	16		1	9		38	4		35
23	5		31	0		50	11		6	16		0	9		14	5	too faſt	2
24	5		27	1		9	11		24	15		59	8		49	5		29
25	5		22	1	too ſlow	29	11		41	15		57	8		23	5		57
26	5		16	1		49	11		58	15		55	7		57	6		23
27	5		10	2		7	12		14	15		52	7		31	6		50
28	5		3	2		27	12		29	15		48	7		5	7		16
29	4		56	2		47	12		45	15		43	6		38	7		41
30	4		48	3		8	13		0	15		37	6		10	8		6
31	4		39	3		28				15		31				8		29

The Third after Leap Year.

	Janua.			Februa.			March			April.			May.			June.		
	M.		S.	M		S.	M.		S.	M		S.	M.		S.	M.		S.
1	8		53	14		49	10		10	0		53	4		9	1		8
2	9		15	14		47	9		54	0		36	4		10	0		56
3	9		37	14		45	9		38	0		20	4		12	0		43
4	9		59	14		42	9		21	0*		4	4		13	0		31
5	10		20	14		39	9		4	0*		11	4		12	0		19
6	10		41	14		34	8		46	0		26	4		12	0*		6
7	11		00	14		29	8		28	0		41	4		11	0*		7
8	11	Watch	18	14	Watch	24	8	Watch	10	0	Watch	55	4	Watch	9	0		20
9	11		36	14		18	7		52	1		9	4		7	0		33
10	11		54	14		1	7		34	1		22	4		4	0		46
11	12		10	14		3	7		15	1		35	4		1	0		58
12	12		26	13		54	6		56	1		48	3		58	1		11
13	12	too faſt	41	13	too faſt	45	6	too faſt	38	2	too ſlow	0	3	too ſlow	53	1	Watch	24
14	12		55	13		36	6		19	2		11	3		48	1		27
15	13		9	13		26	6		0	2		22	3		43	1		30
16	13		21	13		15	5		41	2		33	3		37	2		2
17	13		23	13		4	5		23	2		43	3		31	2		14
18	13		43	12		53	5		4	2		52	3		24	2	too faſt	26
19	13		53	12		41	4		45	3		1	3		17	2		38
20	14		2	12		28	4		26	3		10	3		9	2		50
21	14		11	12		15	4		7	3		18	3		0	3		2
22	14		18	12		1	3		49	3		26	2		52	3		13
23	14		25	11		47	3		31	3		33	2		43	3		25
24	14		31	11		32	3		13	3		41	2		34	3		36
25	14		36	11		16	2		54	3		46	2		24	3		40
26	14		40	11		1	2		31	3		51	2		14	3		57
27	14		43	10		46	2		17	3		55	2		4	4		7
28	14		46	10		30	1		42	3		59	1		53	4		16
29	14		47				1		25	4		3	1		42	4		25
30	14		48							4		6	1		31	4		33
31	14		49				1		9				1		19	4		37

	July.			Auguſt			Septem			October			Novem			Decem.		
	M.		S.	M.		S.	M.		S	M.		S.	M.		S.	M.		S.
1	4		41	4		32	3		43	13		11	15		28	5		49
2	4		39	4		23	4		4	13		25	15		17	5		20
3	4		57	4	Watch	13	4		24	13		39	15		8	4	too ſlow	52
4	5		4	4		2	4		45	13		53	14		58	4		23
5	5		10	3		51	5		5	14		5	14		47	3		54
6	5		13	3		40	5		26	14		17	14		35	3		25
7	5		22	3		27	5		46	14		28	14		23	2		55
8	5	Watch	27	3	too faſt	14	6	Watch	7	14	Watch	39	14	Watch	10	2		25
9	5		31	3		1	6		28	14		49	13		50	1		55
10	5		35	2		48	6		48	14		59	13		41	1		25
11	5		38	2		34	7		9	15		9	13		25	0		56
12	5		41	2		20	7		29	15		18	13		8	0		26
13	5	too faſt	43	2		5	7	too ſlow	49	15	too ſlow	25	12	too ſlow	51	0		*14
14	5		45	1		50	8		9	15		31	12		33	0		*34
15	5		46	1		34	8		29	15		37	12		14	1		4
16	5		46	1		17	8		48	15		43	11		55	1		34
17	5		45	1		0	9		8	15		48	11		35	2		4
18	5		44	0		43	9		28	15		52	10		14	2	Watch	33
19	5		42	0		26	9		47	15		55	10		53	3		2
20	5		41	0*		9	10		7	15		57	10		31	3		31
21	5		39	0*		9	10		27	15		59	10		8	4		0
22	5		35	0		27	10		43	16		0	9		44	4		20
23	5		32	0		46	11		1	16		1	9		20	4	too faſt	50
24	5		28	1		5	11		19	16		0	8		55	5		23
25	5		23	1		24	11		37	15		58	8		30	5		50
26	5		17	1		44	11		54	15		56	8		4	6		17
27	5		11	2		3	12		10	15		33	7		38	6		44
28	5		5	2		22	12		26	15		49	7		12	7		10
29	4		58	2		42	12		41	15		44	6		45	7		36
30	4		50	3		3	12		57	15		38	6		17	8		0
31	4		14	3		23										8		24

EQUATOR: See *Equinoctial.*

EQUES *Auratus*, is uſed to ſignify a Knight, which is called *Auratus*, becauſe antiently none but Knights might gild or beautify their Armour, or other Habiliments of War, with Gold. However, in Law, this Term is not uſed; but inſtead of it *Miles*, and ſometimes *Chevalier.*

EQUIANGULAR [of *æquus* and *angulus*, L.] a Term in *Geometry*, apply'd to Figures whoſe Angles are all equal, as a *Square*, *Parallelogrom*, &c.

EQUICRURAL, having equal Legs. See *Iſoſceles.*

EQUICULUS, or *Equus minor*, a Conſtellation in the northern Hemiſphere, conſiſting of four Stars.

EQUIDIFFERENT [in *Arithmetick*,] equally differing, and is of two kinds.

Continually EQUIDIFFERENT, is when in a Series of three Quantities, there be the ſame difference between the firſt and ſecond, as there is between the ſecond and third; as 3, 6, and 9.

Diſcretely EQUIDIFFERENT *Quantities*, is when in a Series of four quantities, there is the ſame difference between the firſt and ſecond, as between the third and fourth; as 3, 6, 7 and 10.

EQUILATERAL *Triangle*: See *Triangle.*

EQUILATERAL *Hyperbola*. If the Tranſverſe *Diameter* of any *Hyperbola* be equal to its *Parameter*, then all the other Diameters will alſo be equal to their *Parameters*: And ſuch an *Hyperbola* as is this, is called an *Equilateral*, whoſe Aſymptotes do always interſect each other at right Angles in the Center.

EQUILIBRIUM, [in *Mechanicks*,] is when the two Ends of a Balance hang ſo exactly even and level, that neither doth aſcend or deſcend, but do both keep in a Poſition parallel to the Horizon; which is occaſioned by their being both charged with an equal Weight.

EQUIMULTIPLES, are Numbers or Quantities multiplied by one and the ſame Number or Quantity. *See Propoſition*, N°. 13.

EQUINOCTIAL, (in the Heavens) or Equator on the Earth, is a great Circle, whoſe Poles are the Poles of the World. It divides the Globe into two equal Parts, that is, the northern and ſouthern Hemiſpheres. It paſſes through the Eaſt and Weſt Points of the Horizon; and at the Meridian is raiſed as much above the Horizon, as is the Complement of the Latitude of the Place.

Whenever the Sun cometh to this Circle, it maketh equal Days and Nights all round the Globe, becauſe he then always riſes due Eaſt, and ſets due Weſt, which he doth at no other time of the Year, whence it hath its Name. All Stars alſo which are under this Circle, or which have no Declination, do always riſe due Eaſt, and ſet full Weſt, &c.

All People living under this Circle, (which, in Geography, is called the Line) have their Days and Nights equal: At Noon the Sun is in their Zenith, or directly over their Heads, and caſts no Shadow.

From this Circle (on the Globes) is the Declination or Latitude accounted on the Meridian.

And the Circles which run through each Degree of Latitude or Declination, are called Parallels of Latitude or Declination.

Through this Equinoctial all the Hour-Circles are drawn at right Angles to it, and through the Poles of the World, at every 15th Degree, on the Celeſtial Globe.

And the Equator on the Terreſtrial Globe is divided by the Meridians into 36 equal Parts.

The natural Day is meaſured by the Revolution of the Equator, and is ended when the ſame Point of the Equator comes again to the ſame Meridian, which is in 24 Hours.

Wherefore ſince the Equator (as all great Circles are) is divided into 360 Degrees, each Hour muſt be $\frac{1}{24}$ of that Number, or 15 Degrees; therefore 1 Degree of the Equator will contain 4 Minutes of an Hour; and 15 Minutes of a Degree, will make a Minute of an Hour, or 60 Seconds; and conſequently 4 Seconds anſwer to one Minute of a Degree.

Hence the following Tables are made for converting Degrees and Minutes, &c. of the Equinoctial into Time, and *Vice verſa.*

TABLE I.

To convert Parts of the Equinoctial into Time.

Degrees.	Hours.	1
Minutes.	1	2
Seconds.	2	3
Thirds.	3	4
1	0	4
2	0	8
3	0	12
4	0	16
5	0	20
10	0	40
15	1	0
30	2	0
60	4	0
90	6	0
180	12	0
360	24	0

Whoſe Uſe is this:

Suppoſe you would readily know how many Hours, Minutes and Seconds, &c. there are in 19 Degrees, 13 Minutes, 7 Seconds of the Equator.

	H.	′	″	‴
Againſt 15 Degrees, in the firſt Table, you find	1	0	0	0
Againſt 4 Degrees	0	16	0	0
Alſo againſt 10 Minutes you will find	0	0	40	0
And againſt 3 Minutes	0	0	12	0
Then againſt 5 Seconds you will find	0	0	0	20
And againſt 2 Seconds you have	0	0	0	8
Add all up together, and it makes	1	16	52	28

TABLE II.

To convert Time into Parts of the Equinoctial.

Hours	Degr.	Minut.	Degr.	1
		Second	1	2
		Thirds	2	3
		Fourth	3	4
1	15	1	0	15
2	30	2	0	30
3	45	3	0	45
4	10	4	1	0
5	75	5	1	15
6	90	6	1	0
9	135	10	2	30
12	180	20	5	0
15	225	30	7	30
18	270	40	10	0
21	315	50	12	30
24	630		15	0

Again, for the Uſe of this Table.

Suppoſe you would find how many Degrees, Minutes, Seconds, *&c.* of the Equator, anſwer to 23 Hours, 25 Minutes, 17 Seconds, and 9 Thirds.

	H.	'	''	'''
Againſt 21 Hours, in the Table, you find	315	0	0	0
Againſt 2 Hours	30	0	0	0
Againſt 20 Minutes you have	5	0	0	0
And againſt 5 Minutes	1	15	0	0
Then againſt 10 Seconds you find	0	2	30	0
And againſt 5 Seconds	0	1	15	0
Againſt 2 Seconds	0	0	30	0
Then againſt 6 Thirds there is	0	0	1	30
And againſt 3 Thirds you have	0	0	0	45
All which added rightly together, make	351	19	17	15

EQUINOCTIAL *Colure:* See *Colure.*

EQUINOCTIAL *Dial*, is that whoſe Plane lies parallel to the *Equinoctial.*

To make this Dial, is no more than with 60 Degrees of your Line of Chords to deſcribe a Circle, wherein draw two Diameters croſſing each other at right Angles; then divide this Circle into 24 equal Parts or Hours, which ſubdivide as you pleaſe.

Note, That every Hour is 15 Degrees, therefore the Half-hour will be 7 Degrees, 30 Minutes, and the Quarter 3 Degrees, 45 Minutes.

That being done, ſet up a ſtraight Pin perpendicular to the Plane in the Center of the Circle, and place the Plane parallel to the Equinoctial, and the Meridian Line true North and South, and the Dial is fitted.

Theſe Dials are commonly ſet up in a Frame to be elevated to any Latitude.

EQUINOCTIAL *Orient:* See *Orient.*

EQUINOCTIAL *Occident:* See *Occident.*

EQUINOXES, are the preciſe Times in which the Sun enters into the firſt Point of *Aries* and *Libra*; for then moving exactly under the *Equinoctial*, he makes our Days and Nights equal. This he doth twice a Year, about the 10th of *March*, and 12th of *September*; which therefore are called the *Vernal* and *Autumnal Equinoxes.*

It is found by Aſtronomical Obſervation, That the Equinoctial Points (which are the firſt Points of the Signs *Aries* and *Libra*) go backward every Year 50 Seconds.

And our admirable Sir *Iſaac Newton*, taking the Matter into Conſideration, according to his Principles, found, by Calculation, That they muſt recede 49 Minutes, 58 Seconds, which is ſurprizingly near the Truth.

The Space from the *Vernal* to the *Autumnal Equinox*, is 8 or 9 Days longer than from the *Autumnal* to the *Vernal*, by reaſon of the Poſition of the *Perihelion* of the Earth's Orbit near the *Winter* Solſtice.

EQUINUS *Barbatus*, a kind of Comet, called alſo *Equinus Ellipticus*, *Equinus Quadrangularis.* See *Hippeus.*

EQUIPOLLENCE [in *Logick*,] is when there is an *Equivalence* or *Agreement*, either as to the Nature of the Thing, or as to the Grammatical Senſe of any two, or more Propoſitions; or in plain Words, when two Propoſitions ſignify one and the ſame thing, tho' they expreſs it after different manners, they are properly ſaid to be *Equipollent.*

EQUITY, is the Virtue of treating all other Men according to common Reaſon and Juſtice, or as we would be gladly treated our ſelves, when we underſtand rightly what is our due.

EQUITY, is of two Sorts, and thoſe of contrary Effects; for the one doth abridge and take from the Letter of the Law; and the other doth enlarge and add thereto.

The firſt is thus defined; *'Tis the Correction of the Law, made generally in that Part wherein it fails*; which is a Correction much uſed in our Law: As ſuppoſe an Act made, That whoſoever does ſuch a Thing, ſhall be a Felon, and ſuffer Death: Yet if a Madman, or an Infant, who hath no Diſcretion, do the ſame, he ſhall neither be a Felon, nor ſuffer Death.

The other Equity is defined, to be an *Extenſion of the Words of the Law to Cauſes unexpreſs'd, yet having the ſame Reaſon*; ſo that when one Thing is enacted, all other Things are ſo too, that are of the like Degree: As the Statute which ordains, that in Action of Debt againſt Executors, he that doth appear by Diſtreſs ſhall anſwer, doth extend by Equity to Adminiſtrators; for ſuch of them as ſhall appear firſt by Diſtreſs, ſhall anſwer by *Equity* of the ſaid Act: *Quia ſunt in Equali genere. Cow. Interpret.*

EQUITY, in the Law, uſually ſignifies the *Court of Chancery*, where Controverſies are ſuppoſed to be determined according to the exact Rules of *Equity* and Conſcience, by mitigating the Rigor of the Common Law, tho' even by the Common and Statute Law there is alſo an *Equity. Æquitas ſequitur Legem*, is an old Maxim in Law; but from the great Increaſe of Suits in *Chancery*, ſome have thought fit to give it this Conſtruction, That in all Cauſes after a Man hath been at Law, he muſt go into *Equity.*

EQUIVALENCE *in Things*, is that which expreſſes an Agreement in Nature or Circumſtances, between any two Things propoſed.

EQUIVOCAL [in *Logick*,] is that which hath a doubtful or double Signification.

Any Equivocal Word, is that which contains more Significations than one; or that which ſerves for ſeveral Notions. See *Homonymous*.

EQUIVOCAL *Generation*, is the Production of Plants without Seed: Inſects or Animals without Parents in the natural Way of Coition between Male and Female.

The Learned World begins now to be ſatisfied, that there is nothing like this in Nature; and ſince the Uſe of Microſcopes, and a more particular application to Enquiries of this kind, a prodigious number of Plants have been diſcovered to have *Seeds*; and of Animals (*Inſects*) have been found to be produced Univocally, or in the ordinary way of Generation, which before were thought to be Equivocally produced.

Equivocal Generation. There is ſcarce any thing ſeems more to countenance Equivocal Generation, than the Production of Worms, &c. in the Bodies of Animals; and yet Mr. *Andrey*, in his Diſcourſe *de la Generation de Vers dans le Corps de l' Homme Paris*, in 8*vo.* 1700. ſhews, that they breed there by a *Seed* which finds Entrance ſome how into our Bodies; and in particular, he ſhews, that the *Ciron*, or Hand-Worm, iſſues perfectly from its Egg, and after that grows inſenſibly. He judges that the Eggs of ſmall Inſects enter our Bodies by the Air we breathe, and in our Food; and that they are hatch'd there, only when they find an agreeable Heat and Diſpoſition of the Humours and Parts.

Dr. *George Gorden* hath obſerv'd; See *Phil. Tran. N.* 237. that the *Bearers*, or Bearing Buds of Fruit-Trees, are full of Aſperities, and not ſo ſmooth in their *Bark* as the other Parts of the Tree; and that if after Harveſt you look on theſe with a common Microſcope, you will find the Cavities *there* full of Eggs of an oblong Figure, and of a Citron Colour; eſpecially, in ſuch *Years*, and in thoſe Trees, where the Caterpillers have been numerous. From whence he concludes, that we ſhould not ſay Inſects are bred out of Corruption equivocally, and not *ex Ovis*, only becauſe we cannot diſcern the particular Manner of their Propagation. See *Inſects*.

Mr. *Ray* ſaith, it ſeems to him to be moſt probable, that there is no ſuch Thing as *Spontaneous* or *Equivocal Generation*; but that all Inſects are the natural Iſſue of Parents of the ſame Species with themſelves. *Fr. Redi*, in his Book *de Gener. de g'l Inſetti*, hath, I think, cleared up this Point, and ſhew'd there is no Generation of Animals *ex Materia Putrida.* And Dr. *Liſter* hath given an account of the Inſects bred in the By-Fruits and Excreſcencies of Vegetables, in *Phil. Tran. N.* 71, 72, 75.

Mr. *Willoughby* accounts for the *Ichneumon Waſps*, and the manner of their laying their Eggs in the Bodies of other Inſects, as of Caterpillers, &c. *Phil. Tranſ. N.* 76.

Dr. *Liſter*, in *Phil. Tranſ. N.* 83. hath refuted the vulgar Notion, that Horſe-hairs thrown into Water will become animated Bodies; and ſhews, that the appearances of that kind are *Hair-Worms*, actually bred in the *Bodies of other Inſects*, as of the *Common Black Beetle*, &c.

EQUULEUS [in *Aſtronomy*,] a Conſtellation of the northern Hemiſphere. The Stars in the Conſtellation *Equuleus*, in *Ptolemey*'s Catalogue are 4; in *Tycho*'s 4; in Mr. *Flamſtead*'s Catalogue 10.

ERASED, the Herald's Word, expreſſing any thing violently torn off from its proper Place; and 'tis uſed in contradiſtinction to Couped, which ſignifies a Thing clean cut off.

ERECT *Declining Dials*, are thoſe whoſe Planes are not directly oppoſite to any of the four Cardinal Points, but decline from the Meridian or Prime Vertical Circle.

For the drawing of the Hour-Lines on theſe Dials, there is given the Latitude of the Place, and the Declination of the Plane, in order to find,

Firſt, The Height of the Style above the Plane.

Secondly, The Diſtance of the Subſtyle from the Meridian.

Thirdly, The Inclination of the Meridians, or Difference of the Meridians; which are all the Requiſites neceſſary to be known before the Dial can be deſcribed.

1. To find the Style's Height above the Plane, ſay,

As the Radius is to the Co-ſine of the Plane's Declination:

So is the Co-ſine of the Elevation of the Pole, to the Sine of the Style's Height.

2. To find the Subſtyle's Diſtance from the Meridian, ſay,

As the Radius is to the Sine of the Plane's Declination:

So is the Co-tangent of the Elevation of the Pole, to the Tangent of the Subſtyle's Diſtance.

3. To find the Inclination of the Meridians, ſay,

As the Radius is to the Co-tangent of the Declination:

So is the Sine of Elevation of the Pole, to the Co-tangent of the Inclination of the Meridians.

Theſe being found; Then with a Line and Plummet, let fall a Perpendicular to the Horizon, and that ſhall be the Meridian or Hour Line of 12.

Then if your Plane decline $\left\{\begin{array}{l}\text{Weſtward,}\\ \text{Eaſtward,}\end{array}\right\}$ place the Subſtyle's Diſtance (from the Line of Chords) to the $\left\{\begin{array}{l}\text{Right}\\ \text{Left}\end{array}\right\}$ Hand of the Meridian.

Alſo having found the Inclination of the Meridians, find what Angle each Hour makes at the Pole with the Subſtyle, by ſubſtracting 15 Degrees for each Hour that is between the Subſtyle and Meridian, as long as it can be done from the Inclination of the Meridians; and by adding 15 Degrees for the other Hours.

And with the Hour-Angles at the Pole, find the Hour-Arches by this Proportion.

As the Radius: is to the Sine of the Style's Height:: So is the Tangent of the Hour-Angle: to the Tangent of the Hour-Arch.

Of theſe Hour-Angles and Hour-Arches frame a Table, as was ſhewed in making a Horizontal-Dial.

Example.

A *South Erect Dial, declining Eaſtward* 45 Degrees, 00 Minutes. Latitude 51 Degrees, 32 Minutes.

The Requiſites may be found by the foregoing Canons, *viz.*

The Height of the Style,	26	06
Subſtyle's Diſtance from the Meridian,	29	21
Inclination of Meridians,	51	57

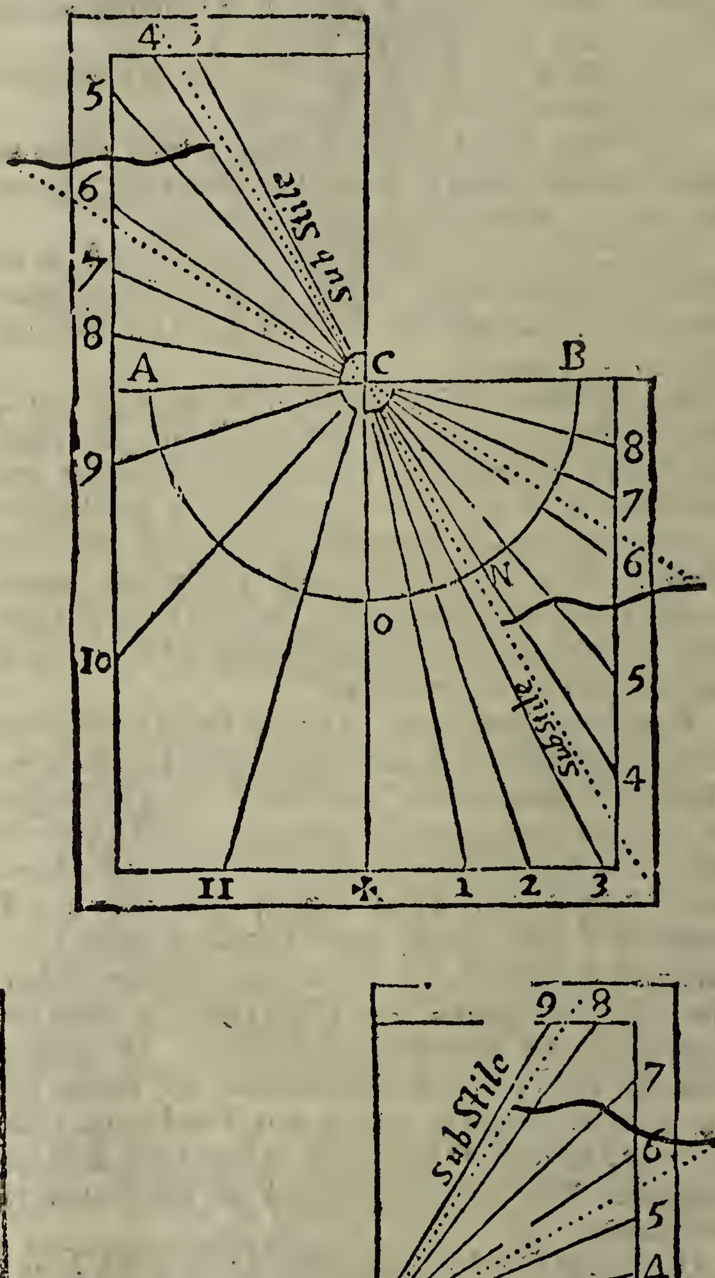
Now, ſince the *Inclination of Meridians* is leſs than 60 Degrees, and greater than 45 Degrees, 'tis certain the *Subſtyle* muſt be between 8 and 9 of the Clock.

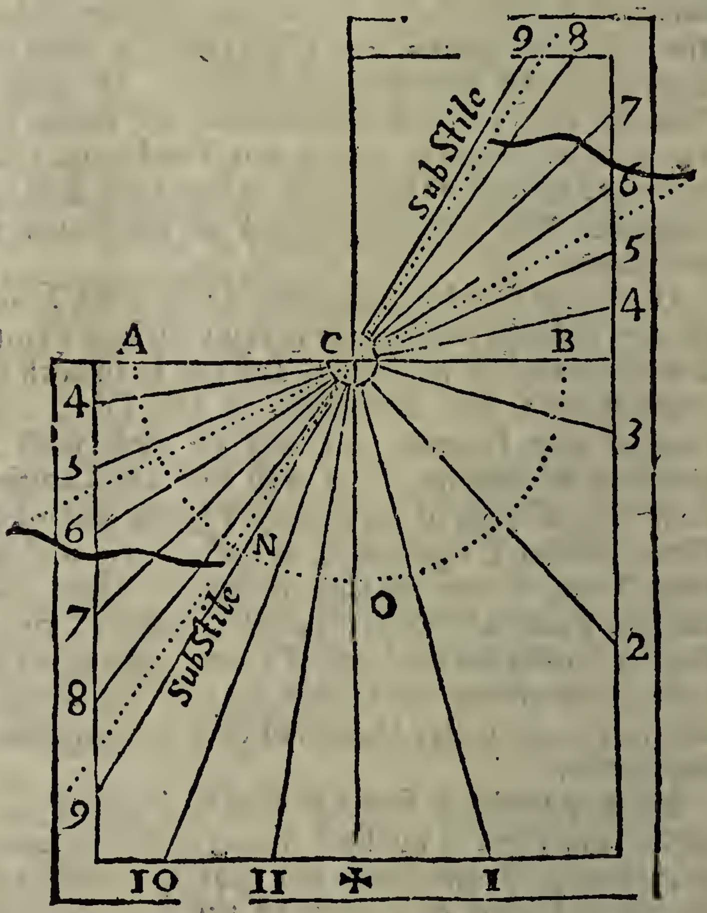
Then the *Hour-Angles at the Pole* are alſo found by ſubducting 15 Degrees from the *Inclination of Meridians,* (ſuppoſed to be ſet againſt 12) the Remainder will be for the Hour 11; and from that Angle againſt 11, ſubſtract 15 Degrees, the Remainder ſet againſt 10; and from that Remainder ſubduct 15 Degrees, the Reſidue ſet againſt 9; and that becauſe 'tis leſs than 15 Degrees, take the difference to 15 Degrees, which ſet againſt 8; then by continual Addition of 15 Degrees, you'll have the Numbers againſt the remaining Hours.

Laſtly, Find the *Hour-Arches* according to the Canon given for that Purpoſe, *viz.* by the continual Addition of the Sine of the *Style's Height,* 26 Degrees, 6 Minutes, to the Tangent of every *Hour's Diſtance from the Subſtyle,* and that will give new Tangents of the *Hour-Arches,* as in the following Table.

The Eaſt Decliner.

Hours	*Angles at Pole.*		*Hour Arches.*	
	D.	M.	D.	M.
3	83	3	74	31
4	68	3	47	31
5	53	3	30	20
6	38	3	19	01
7	23	3	10	37
8	8	3	3	34
Subſtyle	*Subſtyle*		*Subſtyle*	
9	6	57	2	26
10	11	57	10	3
11	36	57	18	19
12	51	57	29	21
1	66	57	45	58
2	81	57	72	27





To deſcribe the Dial.

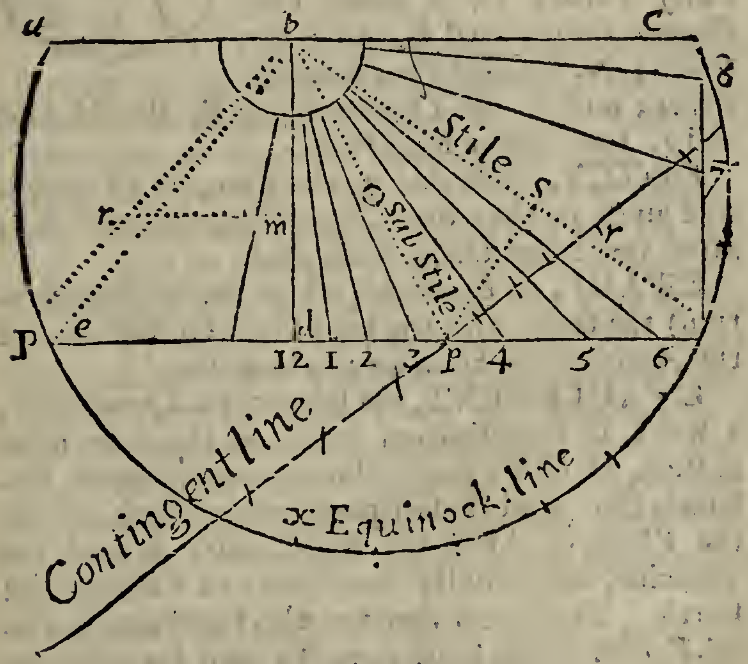
Firſt draw the *Horizontal Line A C B,* and at Right-angles to it the *Meridian C O* 12; then with 60 Degrees of your Line of Chords, from *C* deſcribe the Semi-circle *A O B*; and ſet off 29 Degrees, 21 Minutes, (the *Diſtance of the Subſtyle from the Meridian)* from *O* to *N,* on the Weſt Side of the Meridian, becauſe the Plane declines Eaſt. Set off alſo the ſeveral Hour Arches, (as) 10 Degrees, 37 Minutes, for 7 and 5 a-Clock, 18 Degrees, 19 Minutes, for 11 and 1 a-Clock, &c. both ways from the *Subſtyle* on the Circle *N R O*; and draw Lines from the Center *C* through theſe ſeveral Points: So you'll have the true Hour Lines deſired.

Then from your Chords, ſet off the *Style's Height* 26 Degrees, 6 Minutes from *N* to *R*; and a

Right-line drawn through *R* from *C*, repreſents the Axis or Style, and your *Dial* is finiſhed; as alſo three others, *viz.* a *South Erect Dial, declining Weſt* as much; and a *North Erect Dial, declining Eaſt and Weſt* as much, only placing the Numbers of the Hours and the Style repreſentatively upon each Plane.

An Erect Declining Dial may be Geometrically made thus:

Having given the Elevation of the Pole, and Declination of the Plane;



Firſt draw two Lines interſecting each other at Right-angles: From the Point of interſection, ſuppoſe *b*, make the Angle *e b d* equal to the Elevation of the *Equator*; make another *n b d* equal to the Declination of the Plane. Draw *d e* perpendicular to the Meridian; from any Point taken at pleaſure, ſuppoſe *d*, make *b n* = *d e*; from *n* let fall a Perpendicular to the Meridian *n m*; let this Perpendicular *n m* be transferred, and ſet upon the former Perpendicular on the other Side of the Meridian, equal to *d p*.

Let the *Subſtyle* be drawn through *b* and *p*; unto which, in the point *p*, draw a Perpendicular for the *Contingent*, as *p r*: Then from *b*, through *r*, draw the Style, whoſe altitude above the *Subſtyle* ſhall be equal to the Angle *p b r*.

From *p* to the Style, let fall the Perpendicular *p s*; make *p o* on the *Subſtyle* equal to *p s*: From *o*, at any diſtance, deſcribe the Equinoctial Circle, which divide into 24 or 48 parts, beginning your Diviſion in that part of the Circle, *W*, which is cut by the Ruler applied to *o* and *x*, which is the point of interſection of the *Contingent* and the *Meridian*.

Make points in the *Contingent*, where 'tis cut by a Ruler applied to the Center *o*, and every Diviſion; through which points, from the Center *b*, draw the Hour-Lines.

ERECT *Declining Planes:* See *Dial Planes.*

ERECT *Direct Planes:* See *Dial Planes.*

ERECT *Direct Eaſt or Weſt Dials:* See *Direct Erect Eaſt or Weſt Dials.*

ERECT *Direct South or North Dials.* See *Prime Vertical.*

ERECTORES *Penis*, by ſome called *Erigentes*, by others *Directores*, by *Spigelius*, *Collaterales Penis*; are a pair of Muſcles ariſing fleſhy from the outward Knob of the *Os Iſchium*, below the beginning of the cavernous Bodies of the *Penis*, in whoſe thick Membranes they are inſerted: Their Uſe is to help to erect the *Penis*, which they do by pulling towards the *Oſſa Pubis*, whereby its greateſt Vein is compreſt, and the refluent Blood denied its paſſage under thoſe Bones, and therefore the *Penis* muſt ſwell. *L.*

ERICTHONIUS: See *Auriga.*

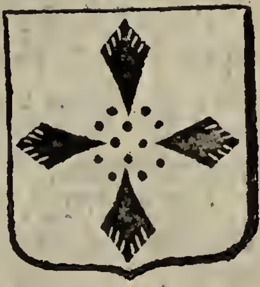
ERIDANUS, [in *Aſtronomy*,] a Conſtellation of the ſouthern Hemiſphere. The Stars in the Conſtellation *Eridanus*, in *Ptolemey*'s Catalogue, are 30; in *Tycho*'s, 19; in Mr. *Flamſtead*'s, 68.

ERMENOIS, is when the Field is *Or*, and the Powdering is *Sable.*

ERMIN, [in *Heraldry*,] ſignifies a Coat where the Field is *Argent*, and the Powdering is *Sable.*

And on the contrary,

ERMINES, is when the Field is *Sable*, and the Powdering *Argent.*



ERMINEE, [in *Heraldry*,] as a *Croſs Erminee*, is a Croſs compos'd of four Ermin Spots, placed in that Figure; the Colours of ſuch Arms are not to be expreſs'd in Blazonry, becauſe neither the Croſs nor the Arms can be of any other Colour than white and black.

ERODENTIA, are Medicines which grow and prey upon the Fleſh with their acute Particles. *Blanchard.*

ERPES: See *Herpes.*

ERRANT, in our Law, is the ſame as *Itinerant*, being attributed to Judges that go the Circuit; and to Bailiffs at large.

ERRATICK, [in *Aſtronomy*,] an Epithet apply'd to the Planets, which are call'd *Erratick*, or *wandring Stars*, in contradiſtinction to the fixed Stars.

ERRHINES ['Eῤῥίνον, Gr.] are Medicines deſigned to purge away pituitous Humours from the Head, without making the Patient ſneeze, tho' to be taken up the Noſe. They are either *Liquid*, *Soft*, or *Solid.*

The *Liquid* are made of the Juices of *Cephalick*, cleanſing Herbs, extracted by Wine or other Liquors; to which Spirit of Wine is ſometimes added; or of a Decoction of fit Simples, to which are added ſometimes Juices, Honey, Syrup, and Powders too.

The *Soft* is made of Powders, with Honey, Oil, or Juices, boiled to a kind of Ointment.

The *Solid* is given either in form of a Powder, and that has place eſpecially in Medicines which provoke ſneezing, or in form of a Pellet, and it is called *Naſale*; and is prepared of fit Powders mixed with viſcid Extractions from Seeds, Gums, Roots, &c. with Wax, or with Turpentine. *Blanchard.*

ERRONES, or *Erratick*, or *Wandring Stars*; the ſame with the *Planets.*

ERROR, [in *Law*,] ſignifies a Fault in pleading, or in the Proceſs, and thereupon the *Writ of*

Error is brought to remedy this Overſight; which *Writ* is that which lieth to redreſs falſe Judgments given in any Court of Record.

There is likewiſe a *Writ of Error* to reverſe a Fine or Recoveries; and for redreſſing and preventing *Errors* in Fines and Recoveries: *Vide* the Statute 23 *Car.* 1. *C.* 3. for inrolling them; and *vide* 16th of *Car.* 2. *C.* 4.

ERYSIPELAS ['Ερυσίπελας of ἐρύω to draw, and πέλας the neighbouring Parts, Gr.] is a Swelling of a bright yellowiſh Colour, inclining to red, (whence its Name is derived) poſſeſſing the Skin, and going no deeper, attended with a pricking Pain, but not beating; it hath a ſymptomatick Fever accompanying it uſually; it is apt to ſpread, and ſometimes bliſters the Skin: If the Skin be preſſed with the Finger, it yieldeth, and the Redneſs vaniſhes for a time.

ERYSIPELATODES ['Ερυσιπελατώδης, Gr.] is a Swelling like the former, tho' with eaſier Symptoms; and therefore may be taken for a kind of *Baſtard Eryſipelas*; in it the Skin is of a more dark Colour.

ERYTHREMATA ['Ερυθρήματα of ἐρυθρῆμα, Gr. redneſs,] are red Spots like Flea-bites, commonly in peſtilential Fevers. *Blanchard.*

ERYTHROIDES ['Ερυθροειδὴς, Gr.] is the red Membrane of the Teſticles, the firſt of the proper Tunicks. *Blanchard.*

ESCALADE, or *Scalade*, is a furious Attack upon a Wall, or a Rampart, carried on with Ladders to mount upon it, without going on in form, breaking Ground, or carrying on of Works to ſecure the Men.

ESCAMBIO, is a Licenſe granted to one, for the making over a Bill of Exchange to another, at Sea, *Reg. Orig. Fol.* 194. For by the Statute of 3 *R.* 2. *c.* 2. no Merchant ought to exchange or return Money beyond Sea, without the King's Licenſe.

ESCAPE, ſignifies, in the *Civil Law*, a violent or privy Evaſion out of ſome lawful Reſtraint.

ESCARP: See *Scharp.*

ESCHAR ['Εσχὰρ, Gr.] is a Cruſt, or hard Skin, Rind, or Shell brought over any Ulcer, or raiſed with a red hot Searing-Iron.

ESCHAROTIC 'Εσχαροτικὸς, Gr.] is a Searing-Iron, actual Fire, a Cautery, or the like, which burns the Skin and Fleſh into a cruſty Subſtance. *Blanchard.*

ESCHEAT, [in *Law*,] ſignifies any Lands or other Profits that fall to a Landlord within his Manor by way of Forfeiture, or the Death of his Tenant, dying without Heir general or ſpecial, or leaving his Heir within Age, and unmarried. *Mag. Charta*, *Chap.* 31. It is alſo us'd for the Place or Circuit within which the King or other Lord hath *Eſcheats* of his Tenants.

ESCHEATOR, is an Officer who takes notice of the King's Eſcheats in the Country, and certifies them into the Exchequer.

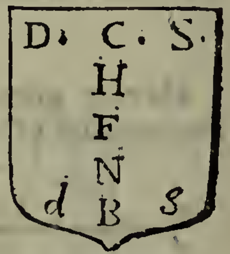
ESCLATTE [in *Heraldry*,] a Term apply'd to a Thing which is violently blown away. *F.*

ESCOCHEON *of Pretence*, is an *Ineſcocheon*, or *little Eſcocheon*, which a Man that hath married an Heireſs, and hath Iſſue by her, may bear over his own Coat of Arms, and in it the Arms of his Wife; and the ſurviving Iſſue will bear both Coats Quarterly.

ESCOUADE, is uſually the third part of the Company of Foot; 'tis ſo divided for mounting of Guards, and for the more convenient relieving of one another: 'Tis equivalent to a *Brigade* of a Troop of Horſe.

ESCROLL [in *Heraldry*,] a *Scroll*, or long ſlip as it were of Parchment or Paper, on which a Motto is plac'd.

ESCUTCHEON, (from *Scutum* a Shield) is the Coat or Field on which any Arms are born in Heraldry; 'tis uſually of this Form: And in it the Heralds give divers Names to ſeveral Points or Places: Thus, the Point D, they call the *Dexter Chief*; C, is the *Middle Chief*; and S, the *Siniſter Chief Point*; H, is called the *Honour Point*; and F, the *Feſſe Point*; N, is called the *Nombril Point*; and *d*, the *Dexter-Baſe*; B, the *Middle*; and *s*, the *Siniſter Baſe-Point.*



ESNECY, *Æſnecia*, in the *Law*, is a Prerogative given to the eldeſt Co-partner, to chuſe firſt, after the Inheritance is divided.

ESPAUL, or *Epaule*; (which ſee in Fortification) the ſame with the Shoulder of a Baſtion, or the *Angle of the Shoulder*; which ſee.

ESPAULEMENT, the ſame with *Epaulement*, a Work in Fortification made on the Side of a Baſtion, of either Earth thrown up, Gabions, Faſcines, &c. And thoſe Epaulements which are for the Places of Arms for the Cavalry behind the Trenches, are uſually made only of Faſcines and Earth. This Word ſignifies alſo ſometimes a *Demi-Baſtion*; and ſometimes 'tis uſed for a *Square Orillon*, or a *Square Maſs of Earth*, faced or lined with a Wall, deſigned to cover the Cannon of a *Cazemate.*

ESPIGURNANTIA, is the Office of *Spigurnel*, or Sealer of the King's Writs.

ESPLANADE, a Term in Fortification, the ſame with the Glacis of the Counterſcarp originally; but now 'tis uſually taken for the empty Space between the Glacis of a Cittadel, and the firſt Houſes of the Town.

ESPLEES, a Term in Law, ſignifying the full Profit that the Ground or Land yieldeth.

ESQUIRE, in *French*, *Eſcuier*, i. e. *Scutiger*, was originally ſuch an one, as attending a Knight in Time of War, did carry his Shield: But now it ſignifies a Gentleman, or one that beareth Arms as a Teſtimony of his Nobility and Gentry; and is a meer Title of Dignity, next to and below a Knight. They who claim this Title now are, all the younger Sons of Noblemen; the four Eſquires of the King's Body; the eldeſt Sons of all Barons, Knights of the Bath, and Knights Batchelors; thoſe that ſerve the King in any worſhipful Calling; ſuch as created Eſquires by the King with a Collar of *SS's* of Silver: The Chief of ſome Families are alſo Eſquires by Preſcription: Thoſe that bear any ſuperior Office in the Common-Wealth; as a Juſtice of Peace, while in Commiſſion, and Utter Bariſters, &c.

ESSAY *Hatch*, is the Miners Term for a little Trench or Hole, which they dig to ſearch for *Shoad* or *Oar*. See *Tin.*

ESSENCE, is that which conſtitutes the peculiar Nature of any thing, and makes it be what it is. Thus the Eſſence of a Circle is, that its Radii, or Semi-diameters be all equal; the Eſſence of a Square is, that it have four Right-angles, and four equal Right-lined Sides.

ESSENCE alſo, in *Chymiſtry*, ſignifies the *Balſamick* Part of any thing ſeparated from the thicker Matter, ſo that whenever this is done by means of Extraction, the *Balſamick* Part is called *Eſſence*, by way of Eminence; ſometimes thickned Juices are called *Eſſences:* But 'tis better to call theſe by their own Name, to avoid Confuſion. Some call Compounds of Oil and Sugar *Eſſences*; but it is an abuſe of the Word. *Blanchard.*

ESSENDI *quietum de Telonia*, is a Writ that lieth for Citizens and Burgeſſes of any City or Town, that hath a Charter or Preſcription, to exempt them from Toll through the whole Realm, if the ſame happen to be any where exacted of them.

ESSENTIAL *Properties*, are ſuch as neceſſarily depend on the Nature and Eſſence of any thing. Thus 'tis the Eſſential Property of every Rectilineal Triangle, to have the Sum of its three Angles equal to two Right ones. And of every Rectangled Triangle to have the Square of the Hypotenuſe equal to the Sum of the Squares of the Legs.

ESSENTIAL *Salt* of Plants is thus drawn: The Plant is pounded in a Mortar and its Juice extracted and filtrated; which after that is ſet in a Cellar, or ſome ſuch cool Place to Cryſtallize; and the Salt will ſhoot out into Cryſtals every way. This Salt is the true or *Eſſential Salt* of the Plant; for here is no change at all made in it by the force of Fire, but the means of drawing it are eaſy and natural.

ESSENTIAL *Oils of Vegetables*, are, according to the Chymiſts, ſuch as are drawn from the Plant in a Limbeck, by the help of Water.

ESSERS, *Sora*, and *Sare*, are little Puſhes or Wheals, ſomething red and hard, which quickly infect the whole Body with a violent itching, as if one were ſtung with Bees, or Waſps, or Flies, or Nettles; yet they vaniſh after a little time, and leave the Skin as ſmooth and well colour'd as before. It differs from an *Epinychis* in this, that an *Epinychis* ſweats out Matter, but an *Eſſer* doth not. *Blanchard.*

ESSOIN [in *Law*,] ſignifies the Allegation of an Excuſe from him that is ſummon'd to appear, and anſwer to an Action real, or to perform Suit to a Court Baron upon juſt Cauſe of Abſence. This the *Civilians* call *Excuſatio.*

The Cauſes that ſerve to *Eſſoin* any Man ſummon'd, are divers; but drawn chiefly to 5 Heads: Whereof

The Firſt is, *Ultra Mare*, whereby the Defendant ſhall have 40 Days.

The Second, *De Terra Sancta*, where the Defendant ſhall have a Year and a Day; and theſe muſt be laid in the beginning of the Plea.

The Third is called, *Malo Veniendi*, call'd alſo *Common Eſſoin.*

The Fourth is, *De malo lecti.*

The Fifth, *De Servitio Regis.*

ESSONIO *de malo lecti*, is a Writ directed to the Sheriff, for the ſending of four lawful Knights to view one that hath *Eſſoin'd* himſelf, *De malo lecti.*

ESSORANT [in *Heraldry*,] a Term uſed to expreſs a Bird ſtanding on the Ground with the Wings expanded as if it had been wet, and were drying it ſelf.

ESTIVAL *Occident:* See *Occident.*

ESTIVAL *Orient:* See *Orient.*

ESTIVAL *Solſtice.*

ESTOILLE [in *Heraldry*,] as a *Croſs Eſtoille*, is a Croſs with only four long Rays, in the manner of a Croſs, and accordingly broad in the Center, and terminating in ſharp Points.

ESTOPPEL, [in *Law*,] ſignifies as much as an Impediment, or Bar of an Action, growing from his own Fact, that hath, or otherwiſe might have had this Action.

ESTORERS. The ſame with *Huſe Bote*, or *Houſe Bote:* Which ſee.

ESTOVERS [in *Law*,] the Suſtenance which a Man, committed for Felony, is to have out of his Lands or Goods, for himſelf and his Family, during his Impriſonment.

ESTRADE, a publick Road, or Highway. Hence *Battre d'Eſtrade*, is a military Phraſe, for ſending out Scouts to get Intelligence.

ESTRANGERS, in the *Law*, are ſometimes taken for ſuch as are not Privies or Parties to the levying of a Fine, or making of a Deed; and ſometimes for thoſe that are born beyond the Seas.

ESTRAY, ſignifies any tame Beaſt found within any Lordſhip, and not own'd by any Man; in which Caſe, being cried, according to Law, in the Market adjoining, if it be not claimed by the Owner, in a Year and a Day, it is the Lord's of the Soil.

ESTREAT [in *Law*,] is uſed for the true Copy or Duplicate of an original Writing. *For Example*, Of Amerciaments or Penalties ſet down in the Rolls of a Court, to be levied by the Bayliff, or other Officer, of every Man for his Offence.

ESTREPE [in *Law*,] is to make Spoil by a Tenant for Life in Lands, or Woods, to the Prejudice of him in Reverſion.

And *Eſtrepement* ſignifies the Spoil made by Tenant for Life upon any Lands or Woods, to the Prejudice of the Reverſioner.

ESURINE *Salts*, are ſuch as are of a corroding, fretting, and eating Nature; they abound in the Air of Places ſituate near the Sea ſide, and where great Quantities of Coal are burnt; as appears from the ſpeedy ruſting of the Iron-Bars in the Windows, *&c.* of Houſes built in ſuch Places.

ETAPPE, in the Art of War, is the Allowance of Proviſions and Forage, which Soldiers have in their March thro' the Kingdom to or from Winter Quarters. Wherefore the

ETAPPIER, is he that contracts with any Country, or Territory, for furniſhing Troops in their March with Proviſions and Forage.

ETATE *probanda:* See *Ætate probanda.*

ETCHING, is a way uſed in making Prints, by drawing with a Needle upon a Copper-plate, covered over with a Ground of Wax, *&c.* and well blacked with the Smoke of a Link, that it may take off the Figure of the Drawing or Print, which having its back-ſide tinctured with white Lead, will, by running over the ſtrucken-out Lines with a *Stift*, impreſs the exact Figure on the black or red Ground; which Figure is afterwards, with Needles, drawn deeper quite thro' the Ground, and all the *Shadows* and *Hatchings* put in; and then a Wax Border being made all round the Plate, there is poured on a ſufficient Quantity of well tempered *Aqua Fortis*, which inſinuating into the Stroaks, made by the Needles in the Ground, eats the Figure of the Print or Drawing into the Copper-Plate. There is no certain Time in which this is done, but uſually the *Aqua-Fortis* will eat deep enough in about half an Hour. *Brown's Ars Pictoria.*

ETHERIAL *Oil*, ſo the Chymiſts call a very fine or exalted Oil, or rather Spirit that is inflammable; as *Oil of Turpentine*, *&c.*

ETHICKS, [Ἠθικὰ of ἦθος manner, *&c.* Gr.] is that Art which teaches us to ſeek out thoſe Rules and Meaſures of human Actions, that lead to true Morality and Happineſs; and which acquaints us with the Means to practice them.

The Writers upon it uſually divide it into two Parts;

The Firſt contains an Account of the Nature of Moral Good and Evil. And

The other enumerates the ſeveral Virtues in which the Practice and Exerciſe of Morality conſiſts; and which are the proper Means for us to obtain true Felicity, the End of all Moral Actions.

ETHMOIDALIS, is a Suture that ſurrounds a Bone of that Name, and ſeparates it from the Bones which are about it.

ETHMOIDES, [Ἠθμοειδὴς, Gr.] is a Bone which reſembles a Sieve, placed above the inner part of the Noſe, and full of little Holes to receive the ſerous and pituitous Humours from the ſoft pappy Proceſſes of the Brain. *Blanchard.*

ETHOPOEIA [Ἠθοποιΐα, Gr.] a Figure in Rhetorick, call'd alſo *Ethology*, and vulgarly *Picture* or *Pourtrait*; and is a Draught or Deſcription, expreſſing the Manners, Paſſions, Genius, Tempers, Aims, *&c.* of another Perſon.

ETYMOLOGY, [Ἐτυμολογία of ἔτυμον, of ἔτυμος true, and λόγος a Word,] is that part of Grammar, which teaches the Original of Words, in order the better to diſtinguiſh and eſtabliſh their true Signification.

EVACUATION [in *Medicine*,] properly an emptying, a diminution of the animal Fluids, in order to a diſcharge of ſome morbid or redundant Matter; or for thinning, attenuating, and promoting the Motion and Circulation of it.

EVANID [*Evanidus*, L.] ſo ſome call thoſe Colours which are not of a very long duration, as thoſe in the Rainbow, in Clouds before and after Sun-ſet, *&c.* Theſe alſo are called *Fantaſtical* and *Emphatical* Colours; which ſee.

EVAPORATION [in *Chymiſtry*,] is when any Liquor is ſet over a gentle Heat, that the Fire may gently carry off ſome of the Moiſture, and yet not leſſen the Quantity of the Matter the Liquor is impregnated with. To *Evaporate to a Pellicle*: See *Pellicle.*

EUCHYMIA, [Εὐχυμία, Gr. *q.d.* good Juice,] is a good Temper of the Blood, or other Juices, or Fluids in an Animal Body.

EUCRASIA [Εὐκρασία, Gr.] is a good Temper of the Parts of the Body.

EVECTION, or *Libration* of the Moon, is an Inequality in her Motion, by which, at or near the Quarters, ſhe is not in that Line which paſſeth thro' the Center of the Earth to the Sun, as ſhe is at her Syzygies, or Conjunction and Oppoſition, but makes an Angle with that Line of two Degrees, fifty Minutes, according to the Obſervation of *Tycho*, and *Bullialdus.*

The Moon revolving uniformly round her Axis, in a Month's time, makes her Day to be of a Month in length; and her Face always is turned the ſame way towards the lower *Umbilicus* of her Orbit; and for that Reaſon, and the Poſition of the *Umbilicus*, deviates this way and that way a little from the Earth; which is her *Libration in Longitude*: But her Libration in Latitude, is occaſioned by the Inclination of the Moon's Axis to the Plane of the Orbit.

EVEN *Number*, is that which may be divided into two Parts; as 4, 10, 40, *&c.* are *Even Numbers*, foraſmuch as each of them may be divided into two equal Parts.

EVENLY *Even*, is that which an *Even Number* doth meaſure by an *Even* one; as 32 is ſaid to be a Number *Evenly Even*, becauſe 8, an *Even Number*, doth meaſure it by 4, which is likewiſe an *Even Number.*

EVENLY *Odd*, is that which an *Even Number* doth meaſure by an *Odd* one; as 30, which 2 or 6, *Even Numbers*, do meaſure by 15 or 5, *Odd Numbers.*

EVENINGS, was formerly the Delivery, at Night or *Even*, of a certain Portion of Graſs or Corn to a cuſtomary Tenant, who performs his wonted Service of mowing or reaping for his Lord; and at the end of his Day's Work, did uſe to receive ſuch a Quantity of Graſs or Corn to carry home with him, as a Gratuity or Encouragement for his bounden Service. *Kennet's Paroch. Antiq.*

EUEXIA [Εὐεξία, Gr.] is a good ſound Habit of Body.

EVICTION [in the *Civil Law*,] is a recovery of the Title to any thing ſold by a Stranger.

EVOLVENT [in *Geometry*,] a Term us'd for the Curve which reſults from the *Evolution* of a Curve, in contradiſtinction to an *Evolute*, which is the firſt Curve ſuppoſed to be opened.

EVOLUTA. See in *Involute* and *Evolute* Figures.

EVOLUTE [in the *Higher Geometry*,] a Curve ſuppos'd to be *evolved* or opened, and which in opening deſcribes other Curves.

EVOLUTION, is uſed by Dr. *Pell*, and others, for the Extraction of Roots out of any Powers; and ſo is directly contrary to *Involution*; which ſee.

EVOLUTION. The equable Evolution of the Periphery of a Circle, or any other Curve, is ſuch a gradual approach of the Circumference to Rectitude, as that all its Parts do meet together, and equally *evolve* or unbend; ſo that the ſame Line becomes ſucceſſively a leſs Ark of a reciprocally greater Circle, till at laſt they turn into a ſtrait Line

In *Philoſ. Tranſ. N.* 260. *p.* 445. you have a new *Quadratix* to the Circle, found by this Means, being the *Curve deſcribed by the equable Evolution of its Periphery.*

EVOLUTION [in *Tacticks*,] is the Motion made by a Body of Men in changing their Poſture, or Form of drawing up; either to make good the Ground they are upon, or to poſſeſs themſelves of another; that ſo they may attack the Enemy, or receive his Onſet more advantageouſly: And theſe *Evolutions*, are *Doubling of Ranks, or of Files, Countermarches*, and *Wheelings.*

Of the Evolution of Powers.

EVOLUTION, is the extracting of Roots from any given Power, being the Reverſe of *Involution*; and in ſimple Quantities it is eaſy, if the given Power have ſuch a Root as is required, which may be thus known.

If the given Power have no coefficient prefixed to it, and if its Index can be divided by the Number denominating the Root required, the Quotient will be the Index of the Root ſought: Thus if the Cube Root of a^6 were required, the Number that denominates the Cube Root is 3; and if 6 the Index of the given Power be divided by 3, the Quotient 2, will be the Index of the Root required,

red, that is, $x^6 3 = x^2$ alſo, if the Cube Root $x^9 \div 3 = 3$

Therefore $\sqrt[3]{x^9} = x^3$

When the given Powers have Coefficients, *viz.* Numbers prefixed to them, then you muſt Extract the Roots of the Powers, and to thoſe Roots prefix the Roots of the Coefficients; ſo ſhall both theſe together be the Root required: Thus, the Cube Root of $27x^6 = 3x^2$ and the Square Root of $81x^6 = 9x^3$. The Powers, not exceeding the tenth of all the Digits, may be found by the following Table, in their reſpective Columns, as alſo, if any of thoſe Powers be given, the Root may be found in the firſt Column.

A Table of Simple Powers.

Roots	Squares	Cubes	4th Power	5th Power	6th Power	7th Power
1	1	1	1	1	1	1
2	4	8	16	32	64	128
3	9	27	81	242	729	2187
4	16	64	256	1024	4096	16384
5	25	125	625	3125	15625	78125
6	36	216	1296	7776	46656	279936
7	49	329	2401	16807	117649	823543
8	64	512	4096	32768	262144	2097152
9	81	729	6561	69049	621441	5592969

If the Cube Root of $216x^{15}$ be required, the Cube Root of $x^{15} = x^5$, and the Cube Root of 216 is by the preceeding Table $= 6$, therefore $6x^5$ is the Cube Root of $216x^{15}$, which was required.

The extracting the Root of any Power repreſented by Numbers, conſiſting of more Places than one, may be performed by the following General Rule.

If the Root required be a Square Root, every ſecond place is to be pointed, beginning from the place of Units; if a Cubic, every third place is to be pointed, beginning from the place of Units; and if it be the Root of a fourth Power, every fourth place, &c. which is called pointing the Reſolvend, or diſtinguiſhing it into Powers.

Then conſider the Figures before and under the firſt Point towards the left-hand, which is called the firſt Power, and find the Root required of thoſe Figures, or Figure, which may be done from the preceding Table: Thus, If it be the ſquare Root, look into the Table of Squares for a Square that is equal to the firſt Period, or the next leſs under it, and the Figure in the column of Roots, oppoſite to that Square, is the Root of the firſt Period, and is to be ſet in the Quotient, and the ſquare of that Figure is to be ſubſtracted from the firſt Period of the Reſolvend; but if it be the Cube Root, that is required in the column of Cubes, a Number equal to, or the next leſs under the firſt Period of the Reſolvend, is to be found, and the Figure oppoſite to that Number, in the Column of Roots, is the Root of the firſt Period of the Reſolvend, and is to be ſet in the Quotient, and the Cube of that Figure muſt be ſubſtracted from the firſt Period of the Reſolvend; and if it be the fourth and fifth, &c. Power which is required, you are to proceed the ſame way for finding the Root of the firſt Period of the Reſolvend, by obſerving to make uſe of a Column for finding a Number equal to, or the next leſs under the firſt Period, whoſe title is the ſame with the given power.

Then to find the Root of the ſecond period, to the firſt remainder bring down the Figure that follows the firſt point, which Sum makes a dividend; and if it be the Square Root that is required, multiply the Quotient by 2 (the Index of the given power) for a diviſor; but if it be the Cube Root, the ſquare of the Quotient is to be multiplied by 3, the Index of the given power, for a diviſor; and if it be a fourth power, the cube of the Quotient is to be multiplied by 4, the Index of the given power, for a diviſor, that is, univerſally to the next leſs power (to that you are extracting) of the quotient, multiply'd by the Index of the given power, muſt always be made a diviſor; and by dividing, the figure that ariſes in the Quotient will be the Root of the ſecond period.

Raiſe the whole quotient to its ſquare cube, &c. according to the power extracting, and ſubſtract that power of the quotient from the two firſt periods of the reſolvend; but if the power of the whole quotient be greater than the two firſt periods of the reſolvend, the figure laſt ſet in the quotient is too big, therefore a leſs figure is to be ſet, till the power of the quotient can be ſubſtracted from the two firſt periods of the reſolvend; to the remainder bring down the firſt place of the third period of the reſolvend, which Sum make a new dividend, and for a diviſor, raiſe the whole quotient to the next leſs power to that given to be extracted, and that Sum multiply by the Index of the given power, as in the following Examples.

Example, I.

If the ſquare Root of 2285126809 be extracted, it will be found 47803, by the preceeding General Rule.

· · · · ·
2285126809 (4 Quotient.

By the preceeding Table, I find 4, the next Root to 22, therefore the ſquare of 4 ſub. 16.

The Root is the next leſs power to ſquare } The Remainder with 8 brought down.
therefore 4×2 = Div. = 8) 68 } (7 the Quotient.
The two firſt periods of the Reſolvend brought down, are } 2285

The ſquare of 47 ſubſtract, *viz.* 2209 } The Remainder with 1 brought down.
The whole quote × by 2 = 47 × 2 = 94) 761 } (8 the Quotient.
The three firſt periods of the Reſolvend brought down, } 228512

The ſquare of the whole Quotient 478 ſubſtract. } 228484
286 The Remainder with 6 brought down.

478×2 = Diviſor = 956) 286 (0 the Quot.
The four firſt periods of the Reſolvend brought down, } 22851268
The ſquare of 4780 ſubſtract 22848400
28680 The Remainder, with 0 brought down.

The whole quote 4780 × 2 = 9560) 28680 (3 Quotient.
The whole Reſolvend is 2285126809
The ſquare of the whole Quote 47803, ſubſtract } 2285126809
0

Theſe five Quotients join'd together, make 47803, the ſquare Root required: And for proof, if the Root 47803 be multiplied by it ſelf, it will produce the given ſquare, 2285126809.

Example, II.

Let the Number 976543210123 be given, and its ſquare Root required: To proceed according to the General Rule, firſt point it, and then find the Root of the firſt period.

· · · · · ·
976543210123 (9 Quotient.

Thus, the ſquare Root of the firſt period is found to be 9, therefore the ſquare of 9 ſubſtract. 81
166 The Remainder, with 6 annexed.

9 × 2 = Diviſor = 18) 166 (8 Quotient.
The two firſt periods brought down 9765
The ſquare of 98 the Quotient, ſubſtract 9604
1614 The Remainder, with 4 brought down.

98 × 2 = Diviſor = 196) 1614 (8 Quotient.
The 3 firſt periods of the Reſolvend 976543
The ſquare of 989 the Quotient ſubſtr. 976144
3992 The Remainder, with 2 brought down.

988 × 2 = Diviſor = 1976) 3992 (2 Quotient.
The four firſt periods of the Reſolvend. } 97654321
The ſquare of the Root 9882 ſubſt. 97653924
3970 The Remainder, with 0 brought down.

The five firſt periods of the Reſolvend. 9765432101
The ſquare of the Quot. 98820 ſubſtract. 9765392400

397012 The Remainder, with 2 annexed.

Quot. = 98820 × 2 = Diviſ. = 197640) 397012 (2 Quotient.
The whole Reſolvend brought down 976543210123
The ſquare of the Quotient 988202 ſubſtract 976543192804

Remainder = 17319

Theſe ſix Quotients joined together, make 988202 for the Root, but the Number given, being a Surd, (that is, not having any even Root) there remains 17319; to which, if Cyphers be added, the decimal part of the Root may be found pretty near, by proceeding according to the General Rule.

Let it be required to extract the Cube Root of 99252847, according to the General Rule.
Firſt, the Number muſt be pointed, beginning at the place of Units; and having pointed every third place, the Sum appears thus:

99252847 (4

The Cube Root of the firſt period, by the Table, is found to be 4, therefore the Cube of 4 ſubſtract. 64

352 The Remainder with 2 brought down.

Quot. = 4 × 4 = 16 × 3 = Div. = 48) 352 (6 Quot.
The two firſt periods of the Reſolvend = 99252
The Cube of the Root 46 ſubſtract 97336

19168 The Remainder, with 8 brought down.

Quot. 46 × 46 = 2126 × 3 = Div. = 6378) 19168 (3 Quotient.
The whole Reſolvend brought down = 99252847
The Cube of the whole Quot. 463 ſubſtract = 99252847

Remains 0

Therefore the three Quotients joined together, *viz.* 463 is the Cube Root of the Number given, 99252847: And for proof, if the Root 463 be multiplied by it ſelf, it will produce its Square; and if that Square be multiplied by it ſelf, it will produce the Cube 97252847, the Number given.
If the Cube Root of 11119431168 be extracted by the General Rule, the Work will appear thus.

11119431168 (2

The Cube of 2 ſubſtract 8

31 The Remainder, with 1 brought down.

Quot. 2 × 2 = 4 × 3 = Div. = 12) 31 (2 Quot.
The two firſt periods of the Reſolvend 11119
The Cube of the Root 22 ſubſtract 10648

4714 The Remainder, with 4 brought down.

Quot. 22 × 22 = 484 × 3 = Div. = 1452) 4714 (3 Quot.
The three firſt periods of the Reſolvend brought down, *viz.* } 11119431
The Cube of the Root 223 ſubſtract 11089567

298641 The Remainder, with 1 brought down.

Quot. 223 × 223 = 49729 × 3 = Div. = 149167) 298641 (2 Quot.
The whole Reſolvend brought down, is 11119431168
The Cube of the Quot. 2232 ſubſtract, is 11119431168

Remains 0

The four Quotients join'd together, make 2232, the Cube Root required.

Let it be required to extract the fifth power of 550731776, whoſe ſurſolid Root is required: According to the General Rule, every fifth place muſt be pointed, beginning at Units, and then it will appear thus:

550731776 (5

The Root of the firſt period is found, by the Table to be 5, therefore the fifth power of 5 ſubſtract, *viz.* 3125

23823 The Remainder, with 3 brought down.

Quot. 5 rais'd to its fourth power 645, and that × by 5 = Diviſor = 3125) 23823 (6 Quot.
The Reſolvend brought down 550731776
The fifth power of the Quot. 56 ſub. 550731776

Remains 0

The two Quotients joined together make 56, the Root required.

Alſo let 184528125 be a given Number, whoſe Surſolid Root is required; being pointed according to the Power

184528125 (4

The Root of the firſt period is 4, therefore the fifth power of 4 ſubſtract, which is = 1024

8212 The Remainder with 2 brought down.

The fourth power of the Quot. 4 is 256 × 5 = Div. = 1280) 8212 (5 Quot.
The Reſolvend brought down 184528125
The fifth power of the Quot. 45 ſubſtract 184528125

Remains 0

The two Quotients joined together, make 45, the Root required.

EUPEPSIA, ['Ευπέψια, Gr.] a good and eaſy Digeſtion.

EUPHONY ['Ευφωνὶα, Gr.] an eaſineſs, ſmoothneſs, and elegancy in Pronunciation.

EUPHORIA, ['Ευφορὶα, Gr.] is the well-bearing of the operation of a Medicine; that is, when the ſick Perſon finds himſelf eas'd or reliev'd by it; then they ſay it wrought upon the Patient *cum Euphoria.*

EUPNOEA ['Ευπνοὴ, Gr.] is a right natural Reſpiration.

EUPORIA ['Ευπορειὰ, Gr.] is an eaſy Preparation of Medicines, or the eaſineſs of their Operation. *Blanchard.*

EURIPUS [in *Geography*] any ſtreight where the Water is in great motion and agitation; it properly ſignifies a Streight between *Bœotia* and the *Negropont.*

EURYTHMY ['Ευρυθμιὰ, Gr. in *Architecture*] ſignifies the exact Proportion between all the Parts of a Building.

EUSARCOS ['Ευσαρκος, Gr.] is one that is well fleſhed. *Blanchard.*

EUSTOMACHUS ['Ευστομάχος, Gr.] is a good Stomach; as alſo Meat convenient for it.

EUSTACHIAN *Tube.* The ſame with the *Aqueductus Fallopii.* See *Tuba Euſtachiana.*

EUTHANASIA ['Ευθανασία, Gr.] is a ſoft quiet Death, or an eaſy paſſage out of this World.

EUTROPHIA ['Ευτροφία, Gr.] is a due nouriſhment of the Body.

EUSTYLE ['Ευστυλος, Gr. in *Architecture*] is a kind of Edifice where the Pillars are placed at a moſt convenient diſtance one from another; the *Intercolumniations* being all juſt two Diameters and a quarter of the Pillar, except thoſe in the middle of the Face before and behind, which are in diſtance three Diameters.

EXCERBATIO. See *Paroxyſmus.*

EXACTION, in *Law,* is a Wrong done by an Officer, or one pretending to have Authority in taking a Reward or Fee for that which the Law allows not. The difference between *Exaction* and *Extortion* is this:

Extortion is where an Officer extorts more than his due.

Exaction is where he wreſts a Fee or Reward where none is due.

EXACTION *Secular,* was any ſort of Tax or Impoſition formerly paid by ſervile and feudatory Tenants.

EXÆRESIS ['Εξαίρεσις of ἐξαιρέω, Gr. *to take away*] is an extraction of things out of the Body that are hurtful to it.

EXAGGERATION [in *Painting*] is a Method whereby the Artiſt repreſenting things, charges them too much, or marks them too ſtrong, either in reſpect of the Deſign or the Colouring.

EXAMINERS *in Chancery,* are two Officers that *Examine,* upon Oath, Witneſſes produced on either ſide, upon ſuch Interrogatories as the Parties to any Suit do exhibit to that purpoſe; and ſometimes the Parties themſelves are by particular Order examined alſo by them.

EXANASTOMOSIS [of ἐξ and ἀναστώμοσις, Gr.] is an opening of the extremity of the Veſſels. *Blanchard.*

EXANTHEMA ['Εξάνθημα of ἐξανθέω, Gr. *to flouriſh*] is a certain Efflorescence upon the Skin of the Head, like thoſe which appear in the Skin of the whole Body. It is deſcribed two ways by *Sennertus*; one is, that at leaſt it changes the colour of the Skin, as in continued malignant Fevers, wherein the Skin is ſpotted as with Flea-bites; the other is, when certain little Swellings break out of the Skin, which may be call'd *Papillæ*. *Blanchard.*

EXARTHREMA, the ſame with *Luxatio.*

EXARTICULATION. See *Diſlocation.*

EXCENTRICK, the ſame with *Eccentrick.*

EXCEPTIO, is the incorporation or mixture of dry Powders with ſome Moiſture or other. Thus Electuaries are made, Powders and Pulps are mixt with Honey or Syrup; and the Powder of Pills with Syrup, Honey, Wine, or Juice.

EXCEPTION, in the *Law*, is a Stop or Stay to an Action; being uſed in the Civil and Common Law both alike, and in both divided into *Dilatory* and *Peremptory.*

EXCEPTIVE *Propoſitions*, are thoſe where a thing is affirmed of the whole Subject, except ſome one of the Inferiors of the Subject, by adding a Particle of Exception, which denotes that what is predicated does not agree with that Inferior, which viſibly includes two Judgments, and renders thoſe Propoſitions compoſed in Senſe. As if one ſhould ſay, *None of the Sects of the ancient Philoſophers, except that of the* Platonic, *have acknowledg'd God to be Incorporeal. The Covetous Man does nothing well but when he dies.*

EXCHANGE, in *Common Law*, is as much as *Permutation* with the *Civilians.* It hath a peculiar Signification, and is uſed for that Compenſation which the Warranter muſt make to the Warrantee, Value for Value, if the Land warranted be recovered from the Warrantee.

EXCHEQUER, is the Court or Place to which are brought all the Revenues belonging to the Crown.

This Court conſiſts, as it were, of two Parts, whereof one dealeth Specially, in the hearing and deciding of all Cauſes appertaining to the Prince's Coffers: The other is called, *The Receipt of the Exchequer*, which is properly employ'd in the receiving and paying Money. It is alſo a Court of Record, wherein all Cauſes touching the Revenues of the Crown are handled.

EXCISION, the cutting out, or cutting off of any part of the Body.

EXCLAMATION, is a violent extenſion of the Voice, when the Mind comes to be diſturbed and agitated with ſome furious Impulſe or Paſſion.

EXCLUSIONS, the *Method of Excluſions* is a Way of coming at the Solution of Problems (in numerical Caſes) by previouſly ejecting or excluding out of our Conſideration, ſuch Numbers as are of no uſe in ſolving the Queſtion; and whereby conſequently the Proceſs may be regularly and judiciouſly abbreviated.

An account of which Method, Mr. *Frenicle* gives, in the *Ouvrages de Mathematique, &c. in Fol. Paris*, 1693.

EXCLUSIVE *Propoſitions*, are thoſe which denote, that a Predicate ſo agrees with its Subject, as to agree with that alone, and no other: Whence it follows, that they include two various Judgments, and by conſequence are compoſed in Senſe. Which is expreſſed by the Word *(only)* or ſome ſuch like Words: thus, *Virtue only makes Nobility, nothing elſe renders a Man truly Noble.*

EXCOMMUNICATO *Capiendo*, is a Writ directed to the Sheriff, for the apprehenſion of him who ſtandeth obſtinately excommunicated Forty Days; for ſuch a one not ſeeking *Abſolution*, hath, or may have, his Contempt certified into the *Chancery*; whence iſſueth this Writ for the laying of him up without Bail or Mainpriſe, until he conform himſelf. *L.*

EXCOMMUNICATO *Deliberando*, is a Writ to the Under-Sheriff, for the Delivery of an Excommunicate Perſon out of Priſon, upon Certificate of the Ordinary of his Conformity to the Juriſdiction Eccleſiaſtical. *L.*

EXCOMMUNICATO *Recipiendo*, is a Writ whereby Perſons excommunicated being for their Obſtinacy committed to Priſon, and unlawfully delivered thence before they have given Caution to obey the authority of the Church, are commanded to be ſought for, and laid up again. *L.*

EXCORIATION, is when the Skin is rubb'd or torn off, or fretted away from any part of the Fleſh.

EXCORTICATION: See *Decortication.*

EXCREMENTS, of an animal Body, are whatſoever is ſeparated from the *Aliments* after Concoction, and is to be thrown out of the Body; as the Moiſture of the Mouth, Spittle, Snot, Milk, Bile, Sweat, the Wax of the Ears, the Excrements of the Belly and Bladder. *Blanchard.*

EXCRESCENCE, a ſuperfluous or unneceſſary piece of Fleſh, or other Matter growing on certain parts of the Bodies of *Animals*, contrary to, or beyond the ordinary Structure of Nature, as Wens, Warts, or any ſort of Swelling, and more particularly a fleſhy Tumour.

EXCRETION, the ſeparating of Excrements, or excrementitious Humours from the Aliments and Blood.

EXCRETORY [in *Anatomy*,] a Term apply'd to certain little Ducts or Veſſels, which make part of the Structure or Compoſition of the Glands.

Circles of EXCURSION [in *Aſtronomy*,] are Circles parallel to the Ecliptick, at ſuch diſtance from it, as is capable of comprehending or bounding the greateſt Digreſſions of the Planets from the ſame; which is commonly about 10 Degrees.

EXECUTION [in *Common Law*,] ſignifies the laſt Performance of an Act: As of a *Fine*, or of a *Judgment*; that of a *Fine*, is the obtaining Poſſeſſion actually of things contained in the ſame by vertue thereof, which is either by Entry into the Lands or by Writ.

There are two ſorts of *Executions*, one *Final*, another with a *Quouſque*, tending to an End.

An *Execution Final*, is that which maketh Money of the Defendant's Goods, or extendeth his Lands, and delivereth them to the Plaintiff; for this the Party accepteth in Satisfaction, and this is the End of the Suit, and all that the King's Writ commandeth to be done.

The other Sort with a *Quouſque*, is tending to an End, and not Final, as in the Caſe of a *Capias ad Satisfaciendum, &c.* This is not final, but the Body of the Party is to be taken, to the intent and purpoſe to ſatisfy the Defendant; and his Impriſonment is not abſolute, but until the Defendant do ſatisfy: So that the Body is but a Pledge for the Debt.

EXECUTIONE *facienda*, is a Writ commanding Execution of a Judgment. *L.*

EXECUTIONE *facienda in Withernamium*, is a Writ that lieth for the taking of his Cattle, who formerly hath convey'd out of the Country the Cattle of another; ſo that the Bayliff having Authority from the Sheriff to replevy the Cattle ſo convey'd away, could not execute his Charge. *L.*

EXECUTOR, is he that is appointed by any Man in his laſt Will and Teſtament, to have the diſpoſing of all his Subſtance, according to the Contents of the ſaid Will. This *Executor* is either *Particular* or *Univerſal: Particular*, as if this or that thing only be committed to his Charge: *Univerſal*, if all.

EXECUTOR *de ſon tort*, is he that takes upon him the Office of an *Executor* by Intruſion, not being ſo conſtituted by the Teſtator, nor for want thereof appointed by the Ordinary to adminiſter.

EXEGESIS ['Εξηγησις of ἐξηγȣ̃μαι, Gr. to explain,] an Explication; alſo a Diſcourſe by way of Explication, Comment, or *Eclairciſſement* on any thing.

EXEGESIS *Numeroſa aut Linealis*, is the Numeral or Lineal Solution or Extraction of Roots out of *adfected Equations* in *Algebra*, firſt invented by *Vieta. Ozanam* calls it *La Rhetique.* Of this you have a very good Account by the famous Mr. *Collins*, in *Phil. Tranſ. N.* 46. L.

EXEMPLIFICATION *of Letters Patents*, is a Copy or Duplicate of Letters Patents, made from the Inrollment thereof, and ſealed with the Great Seal of *England*; which *Exemplifications* are as effectual to be ſued or pleaded as the Originals themſelves.

Note, That nothing but Matter of Record ought to be *exemplified.*

EXEMPLIFICATIONE, is a Writ granted for the Exemplification of an Original.

EXERGUM [of ἐξ and ἐργον, Gr. a Work,] a little ſpace around or without the Work or Figures of a Medal, which is left for an Inſcription, Cypher, Device, Date, &c. to be put.

EXFOLIATION [of *ex* and *folium*, L. a Leaf,] a Term apply'd by Surgeons to the ſcaling of a Bone; or its riſing and ſeparating in Leaves and Lamiræ. *L.*

An EXFOLIATIVE *Trepan*, [in *Surgery*,] a Trepan or ſort of Inſtrument to ſcrape, and at the ſame time to pierce a Bone, and ſo to exfoliate or to raiſe Leaves or Flakes one after another.

EX *gravi Querela*, is a Writ that lieth for him, to whom any Lands or Tenements in Fee within a City, Town, or Borough, being deviſable, are deviſed by Will, and the Heir of the Deviſor entreth into them, and detaineth them from him.

EXHALATION, is whatever is raiſed up from the Surface of the Earth or Water by means of the Heat of the Sun, that of the ſubterraneous Fire, &c. ſuch as Vapours, Miſts, Fogs, &c.

EXHALATIONS and *Vapours*, are commonly us'd indifferently; but they are diſtinguiſhed by the more accurate Writers, who appropriate the Term *Vapour* to thoſe moiſt Fumes that are rais'd from Water, and other liquid Bodies; and thoſe dry ones, which are emitted from ſolid Bodies, as the Earth, Fire, Sulphurs, Salts, Minerals, they call *Exhalations.*

So that if *Exhalations* be taken in this Senſe, they are dry, ſubtil Corpuſcles, or *Effluvia*, which are looſened and freed from hard, earthy Bodies, either by the Heat of the Sun, or the Agitation of the Air, or ſome other Cauſes; and being emitted upwards to a certain Height of the Atmoſphere, they there mix with the *Vapours*, and help to conſtitute or form Clouds, and thence return back in Dews, Miſts, Rain, Snow, Hail, &c.

The nitrous and ſulphureous *Exhalations* are the chief Matter of which Thunder, Lightening, and divers other Meteors are generated in the Air.

True and *permanent* Air, according to Sir *Iſaac Newton*, is formed from the *Exhalations* rais'd from the hardeſt and moſt compact Bodies.

EXHAUSTED *Receiver*, is that Body or Veſſel of Glaſs, &c. which hath the Air drawn out of it by Mr. *Boyle's*, or any other Engine for that purpoſe; and which, tho' not containing an abſolute *Vacuum*, ſeems to be empty of all true elaſtick Air, and therefore is, properly ſpeaking, *Exhauſted* of Air.

EXHAUSTIONS, a Term in *Mathematicks*, where they have what they call, *The Method of Exhauſtions*, of frequent Uſe with the ancient Mathematicians, ſuch as *Euclid*, *Archimedes*, &c. This is founded on what *Euclid* ſaith in his tenth Book, *viz. That thoſe Quantities whoſe Difference is leſs than any aſſignable, are equal*; for if they were unequal, be the Difference never ſo ſmall, yet it may be ſo multiplied, as to become greater than either of them; if not ſo, then it is really nothing. This he aſſumes in the Proof of the firſt Prop. of Book 10. which is, *That if from the greater of two Quantities you take more than its half, and from the Remainder more than its half, and ſo continually, there will at length remain a Quantity leſs than either of thoſe propoſed.*

On this Foundation they demonſtrate, That if a regular Polygon of infinite Sides be inſcribed in, or circumſcribed about a Circle, the ſpace that is the difference between the Circle and the Polygon, will, by degrees, be quite exhauſted, and the Circle equal to the Polygon: *Vid. Archimed. de Dimenſione Circuli.* Wallis's *Algebra*, *P.* 280. Pardie's *Elements of Geometry*, *Book* 4. *Prop.* 28.

EXHIBIT [in *Law*,] is when a Deed, Acquittance, or other Writing, is in a Chancery Suit *exhibited* to be proved by Witneſs; and the Examiner writes on the back, That it was ſhewed to ſuch a one at the ſame time of his Examination: This is there call'd *An Exhibit.*

EXHIBITION, was anciently an Allowance for Meat and Drink, ſuch as the religious Appropriators made to the poor depending Vicar. And this Word is ſtill retained in the Colleges of *Oxford* and *Cambridge*, in nearly the ſame Senſe.

EXIGENDARY: See *Exigenter.*

EXIGENT, is a Writ that lieth where the Defendant in an Action Perſonal cannot be found, nor any thing within the County whereby he may be attached or diſtrained; and is directed to the Sheriff, to proclaim and call five County Days one after another, charging him to appear under the pain of Outlawry. This Writ lieth alſo in an Indictment of Felony, where the Party indicted cannot be found.

EXIGENTER, is an Officer in the Court of *Common Pleas*, whereof there are Four. They make all Exigents and Proclamations in all Actions where Proceſs of Outlawry doth lie, and Writs of *Superſedeas*, as well as the *Protonotaries* upon ſuch Exigents as were made in their Offices. But making Writs of *Superſedeas* is now taken from them by an Officer in the ſame Court.

EX *Mero motu*, are Words formerly uſed in any Charter of the Prince, whereby he ſignifieth, That he doth that which is contained in the Chater, of his own *Will and Motion*, without Petition or Suggeſtion made by any other; and the effect of theſe Words, are to bar all Exceptions that might be taken unto the Inſtrument wherein they be contained, by alledging, That the Prince in paſſing that Charter, was abus'd by any falſe Suggeſtion. *L.*

EX OFFICIO. By a Branch of a Statute of 1 *Eliz.* 1. The Queen, by her Letters Patents, might authorize any Perſons, *&c.* to adminiſter an Oath *Ex Officio*; whereby the ſuppoſed Offender was forced to confeſs, accuſe, or clear himſelf of any Criminal Matter, *&c.* But this Branch, relating to the ſaid Oath, is repeal'd by *Stat.* 17. *Car.* 1. *c.* 11.

EXOMPHALOS ['Εξόμφαλος, Gr.] is a Protuberance of the Navel, common to Infants.

EXONERATIONE *Sectæ*, is a Writ that lieth for a King's Ward to be diſburthened of all Suit, *&c.* to the County, Hundred, Leet, or Court-Baron, during the time of his Wardſhip.

EXOPHTHALMIA [of 'Εξοφθαλμία, Gr.] is a Protuberance of the Eye, out of its natural Poſition.

EXOSTOSIS, ['Εξοστωσις of ἐξ and ὀστέων, Gr. a Bone,] is any unnatural Protuberance of a Bone; or rather a ſwelling cauſed by a Bones being out of its natural Place or Poſition.

EXPANSION. Mr. *Lock* ſaith this Word expreſſes the Idea which we have of *Laſting Diſtance*, all whoſe parts exiſt together, which is a Metaphyſical Notion of the Word. What is meant by it in a Phyſical Senſe, you will in part ſee under *Exploſion*. Tho' *Expanſion*, among Naturaliſts, is often taken alſo for the ſwelling or increaſe of the apparent Bulk of the Fluids, when agitated by Heat. And the Quantity of this, in ſeveral Inſtances, Mr. *Halley* gives in *Philoſ. Tranſ. N.* 197. where he ſhews, That by Experiment Water was found by him to expand it ſelf one 26th part of its Bulk when it was made to boil, but hardly would it expand at all by a moderate Heat.

But *Mercury* did with a very gentle Heat expand it ſelf one 74th part of its uſual bulk when cold.

Spirit of Wine, with an Heat (at higheſt) that was much leſs than that of boiling Water, expanded it ſelf gradually till it had increaſed to a 12th part of its bulk when cold, and then fell a boiling and emitting Bubbles copiouſly.

There is alſo an *Expanſion* of Water made by freezing, which Mr. *Boyle*, in his Book of Cold, tells us, he found to be about $\frac{1}{10}$ part of a ſpace more than the Water uſually takes up.

The Law of the *Expanſion* of Air is this, *That the Spaces unto which Air of a given Quantity is compreſſed, are reciprocally proportionable to the compreſſing Weights.* Philoſ. Tran. N. 13. Whence Dr. *Gregory* proves, *Aſtron. p.* 407. That a Globe of Air of but one Inch in Diameter, if it had ſo great an Expanſion as it will have at a Semidiameter's Diſtance of the Earth from it, will fill all the planetary Regions, as far as, and far beyond the Sphere of *Saturn*.

EX PARTE *talis*, is a Writ that lyeth for a Bayliff or Receiver, that having Auditors aſſigned to hear his Account, cannot obtain of them reaſonable Allowances, but is caſt into Priſon by them. The manner in this Caſe, is to take this Writ out of the *Chancery*, directed to the Sheriff, to take the four Mainpernors, to bring his Body before the Barons of the *Exchequer*, at a Day certain, and to warn the Lord to appear at the ſame time.

EXPECTANT, *Fee*, in *Common Law*, ſignifies Land given to a Man, and to the Heirs of his Body, the Remainder to him and his Heirs. Here is a Fee-Simple Expectant after the Eſtate *Tail*.

EXPECTORATION [in *Medicine*] the act of evacuating or bringing up of Phlegm or other Matter from the Lungs, by coughing, hoking, ſpitting, *&c.*

EXPEDITATION [in the *Foreſt Law*] the cutting out the Ball of Dogs Fore-feet, in order to preſerve the King's Game.

EXPENSIS *militum levandis*, is a Writ directed to the Sheriff, for levying the allowance for Knights in Parliament.

EXPENSIS *militum non levandis ab hominibus de dominico, nec à Nativis*, is a Writ to prohibit the Sheriff from levying any allowance for the Knights of the Shire, upon thoſe that hold in ancient Demeſne, *&c.*

EXPERIMENT [in *Philoſophy*] is the trial of the reſult or effect of certain applications and motions of natural Bodies, in order to diſcover ſomething of the motions and relations of them, to aſcertain ſome *Phænomena* or the cauſes of them.

EXPERIMENTUM *Crucis*, is ſuch an Experiment, as like a Croſs ſet up where divers ways meet, to direct Travellers in their true Courſe, guides and directs Men into the true Knowledge of the nature of the thing they enquire after.

EXPILATION [in the *Civil Law*] the act of withdrawing or diverting any thing belonging to an Inheritance before any Perſon has declared himſelf to be Heir thereof.

EXPIRATION, is an alternate Contraction of the Cheſt, whereby the *Air*, together with fuliginous Vapours, is expelled by the Wind-pipe.

EXPLETORY *Juſtice.* See *Juſtice.*

EXPLOSION, properly ſignifies a Hiſſing off the Stage; but by Naturaliſts, an action of the *Animal Spirits*, whereby the Nerves are ſuddenly contracted; the reaſon is, That ſome *Heterogeneous Particles* are mixed with the *Animal Spirits*, by which they are violently expanded and driven into a Confuſion, like the parts of fired Gunpowder. That violent Efferveſcence, Ebullition and Expanſion which ariſes from the mixture of ſome contrary Liquors, is called *Exploſion*, of which Mr. *Boyle* gives ſeveral Experiments at the end of his Experiments about *Flame* and *Air*; as when Spirit of Nitre and Spirit of Wine, Oil of Vitriol and Oil of Turpentine, and when Oil of Vitriol and *Sal Armoniac* are mingled together.

EXPONENT *of the Ratio*, or Proportion between any two Numbers or Quantities, is the Quotient ariſing when the *Antecedent* is divided by the *Conſequent*: thus, 6 is the Exponent of the Ratio which 30 hath to 5. Alſo a Rank of Numbers in *Arithmetical Progreſſion*, beginning from 0, and placed over a Rank of Numbers in *Geometrical Progreſſion*, are called *Indices*, or *Exponents*: And in this is founded all the Reaſon and Demonſtration of *Logarithms*; for *Addition* and *Subſtraction* of theſe *Exponents*, anſwers to *Multiplication* and *Diviſion* in the *Geometrical Numbers*, as you will find more at large in the Word *Logarithm*.

EXPONENTIAL *Curves*, are ſuch as partake both of the Nature of *Algebraick* and *Tranſcendant* ones. They partake of the former, becauſe they conſiſt of a finite Number of Terms, tho' thoſe Terms themſelves are indeterminate: And they are in ſome meaſure *Tranſcendental*, becauſe they cannot be algebraically conſtructed.

EXPONENTIAL *Equations*, are ſuch as Sir *Iſaac Newton* calls *Geometrick Irrationals*; they are ſometimes alſo call'd *Tranſcendental*.

EXPONENTIAL *Quantities*, are ſuch whoſe Exponents are indeterminate, variable, or flowing Quantities; and the Quantities are of ſeveral Degrees and Orders. When the Exponent is a ſimple indeterminate Quantity, 'tis called an *Exponential* of the firſt or loweſt Degree.

When the Exponent it ſelf is an *Exponential* of the firſt Degree, then the Quantity is an *Exponential* of the ſecond Degree, &c.

Thus zy is an *Exponential* of the firſt Degree; becauſe the Quantity y is a ſimple flowing Quantity. But $z^{y^{x}}$ is an *Exponential* Quantity of the ſecond Degree; becauſe y^x is an *Exponential* of the firſt Degree. So alſo $z^{y^{x^{y}}}$ is an *Exponential* of the third Degree; the Expotent $y^{x^{y}}$ being one of the ſecond.

See *D. Bernoulli's Tractatus de principiis Calculi Exponentialis*: And *Craig's* Correction alſo of a Miſtake in it; in *Phil. Tranſ. N.* 245. *p.* 374.

Hayes Fluxions, *p.* 306. Where are Rules to find the Fluxions of *Logarithms*, and of *Powers*, when the Exponents are flowing Quantities. As alſo how to conſtruct *Exponential Curves*, and to determine their *Tangents*.

EXPRESSION, in *Chymiſtry* or *Pharmacy*, is the Term for the Action of preſſing out the Juices or Oils of Vegetables; and thus Oils ſo made, are called Oils by *Expreſſion*; as thoſe made by Fire are called *Stillatitious Oils*.

EXPRESSION [in *Painting*,] is the natural and lively Repreſentation of the Subjects, or the ſeveral Objects intended to be ſhewn.

EXPREST *Oils*, are thoſe that are prepared by ſqueezing out the oily Juice of Fruits or Seeds; ſuch as Oil Olive, Oil of ſweet and bitter Almonds.

EXPROMISSOR, [in the *Civil Law*,] is one that diſcharges the firſt Debtor, and takes the Burden upon himſelf.

EXPURGATION [in *Aſtronomy*,] a Term us'd by ſome Authors, for the State or Action of the Sun, wherein, after it has been eclipſed and hid by the interpoſition of the Moon, it begins to appear again; the ſame that modern Aſtronomers call *Emerſion*.

EXSICCATION [in *Chymiſtry*, &c.] is the act of drying or evaporating the moiſture of a thing *L.*

EXTASY ['Εξτασις, Gr.] is a Depravation of the Judgment and Imagination, familiar to mad and melancholy Perſons.

EXTEND. To extend, in a Legal Senſe, ſignifies the valuing of Lands and Tenements of one bound by Statute, &c. and hath forfeited his Bond, to ſuch an indifferent Rate, as that, by the yearly Rent, the Obligator may in time be fully paid his Debt.

EXTENDI *Facias*, is a Writ commonly called, *A Writ of Extent*, whereby the Value of the Land, &c. is commanded to be made and levied in divers Caſes. *L.*

EXTENSION [in *Phyſicks*,] is that whereby a thing is conſtituted long, broad, or deep, &c. *L.*

EXTENSOR *Carpi Radialis*, is a Muſcle of the Wriſt, by ſome called *Bicornis*, and *Radiæus externus*. It has two Beginnings, and indeed ſeems to be two diſtinct Muſcles, the outermoſt ariſing fleſhy above the external Protuberance of the *Os Humeri*, immediately below the *Supinator Radii Longus*; in its deſcent becomes a fleſhy Belly, and grows tendinous above the middle of the *Radius* The other Beginning of this Muſcle is partly fleſhy and partly tendinous below the former, either from the *Apex* of the Extuberance of the *Os Humeri*, or ſuperior part of the *Radius*, and continues fleſhy ſomewhat lower than the ſuperior, both Tendons marching under the *Extenſores Pollicis*, run under the *Ligamentum Annulare*, and are inſerted to the ſuperior parts of the *Oſſa metacarpi* of the fore and middle Fingers. *L.*

EXTENSOR *Carpi Ulnaris*, is a Muſcle of the Wriſt, which hath an acute tendinous Beginning from the outward Extuberance of the *Os Humeri*, and becomes fleſhy as it deſcendeth, according to the length of the *Cubit*, growing tendinous again, as it marcheth over the inferior part of the *Ulna*; and paſſing under the annular Ligament, it is inſerted to the ſuperior part of the metacarpal Bone of the little Finger. If this Muſcle and the *Ulnaris Flexor* act, they move the Hand ſideways towards the *Ulna*; and in like manner, if the *Radialis Flexor* and *Extenſor* act, they move it towards the *Radius*. *L.*

EXTENSOR *Digitorum Communis*, *ſeu Digitorum Tenſor*, is a Muſcle of the Fingers, which has an acute tendinous Origination from the outward Extuberance of the *Os Humeri*, between the *Extenſores Carpi*, becoming fleſhy in leſs than half its progreſs. It is divided into three portions, which become ſo many Tendons, (of which the middlemoſt is the longeſt) paſſing under their annular Ligaments between the loweſt parts of the *Ulna* and *Radius*, march ſeparately over the *Dorſum Manus*, and remitting tendinous Filaments to each other as they paſs the firſt Internodes of each Finger, and are afterwards inſerted to the ſuperior parts of the firſt, ſecond, and third Bones of the fore, middle, and third Fingers.

There being no Force required in the Extenſion of the Fingers, we need not wonder that the Muſcles employ'd in that Office, are no larger in proportion to their Antagoniſts.

EXTENSOR *Indicis*, *ſeu Indicator*, is a Muſcle of the Fingers, which ariſes fleſhy from the middle of the external part of the *Ulna*, next the *Radius*, immediately below the *Extenſores Pollicis*, and deſcending obliquely, becomes tendinous as it paſſes under the annular Ligament at the lower part of the *Radius* and *Carpus*, paſſing over the *Os Metacarpi Indicis*, and joining with the Tendon of the *Extenſor Communis*, is inſerted with it to the ſuperior part of the third Bone of the fore Finger. The Tendon of it is ſometimes divided. Its Name declares its Uſe, which is to extend the Fore-Finger. *L.*

EXTENSOR *Primi Internodii Pollicis*, is a Muſcle of the Thumb, which ariſes tendinous from the upper part of the *Ulna*, immediately below the *Supinator Radii brevis*, ſoon growing fleſhy, and becomes tendinous again, as it deſcends obliquely over the Tendons of the *Radialis Extenſor*, and is inſerted to the ſuperior part of the firſt Bone of the Thumb This is divided into two, and ſometimes into three diſtinct Muſcles. *L.*

EXTENSOR *Secundi Internodii Oſſis Pollicis*, is a Muſcle of the Thumb, which ariſes broad and fleſhy from that part of the *Radius* next the *Ulna*, and becoming tendinous, paſſes under the ſame *Involucrum*, with the Tendons of the *Extenſor primi*, &c. to its Implantation of the ſuperior part of the ſecond Bone to the Thumb. *L.*

EXTENSOR *Tertii Internodii Oſſis Pollicis*, is a Muſcle of the Thumb, which has a broad, partly tendinous, but chiefly fleſhy Origination from the *Ulna*, immediately below the beginning of the *Extenſor primi Internodii*, or between it and the Indicator; as alſo from the Ligament between the laſt named Bone and the *Radius*; whence deſcending obliquely, becoming tendinous as it marches in a proper *Sinus* on the inferior *Appendix* of the *Radius*, wherein it's encloſed by its annular Ligament, and paſſes over the two Tendons of the *Radialis Extenſor*, to its Inſertion at the ſuperior part of the third Bone of the Thumb. When this acts, it does not only extend the Thumb, but brings it ſomewhat backwards, inſomuch that ſome Perſons can place it on the ſuperior and back part of the *Oſſa Metacarpi*. L.

EXTENSOR *Minimi Digiti*, is a Muſcle which ariſes partly tendinous at the Extremity of the external *Apophyſis* of the *Os Humeri*; and partly fleſhy from the ſuperior part of the *Ulna*, between the *Extenſor Communis Digitorum*, and *Muſculi Ulnaris Extenſor*; and becoming tendinous as it paſſes under the *Ligamentum Annulare* at the *Carpus*, it is there divided into two, ſometimes three Tendons, which are united in one at its Inſertion to the ſuperior part of the third Bone of the little Finger. Its Name declares its Action. *L.*

EXTENSOR *Pollicis Pedis Brevis*, is a Muſcle of the great Toe, ariſing fleſhy from the fore part of the *Os Calcis*, being dilated into a Belly, ſoon becomes a long ſlender Tendon, paſſing obliquely over the upper part of the Foot, and is inſerted to the ſuperior part of the ſecond Bone of the great Toe, which it extends or pulls upwards. *L.*

EXTENSOR *Pollicis Pedis Longus*, is a Muſcle of the great Toe, which takes its beginning large and fleſhy, from the fore part of the *Fibula*, from immediately below its ſuperior *Appendix*, to four Finger's Breadth above the inferior one; and deſcending under the *Ligamentum Annulare* of the *Tarſus*, between the Tendon of the *Tibialis Articus*, and thoſe Tendons of *Extenſor Pedis Longus*, and marching along the ſuperior part of the Foot, is inſerted to the upper part of the ſecond Bone of the great Toe. Its Name intimates its Uſe to be, to extend the Toe. *L.*

EXTENT [in *Law*,] hath two Significations, ſometimes ſignifying a Writ or Commiſſion to the Sheriff for the valuing of Lands or Tenements; ſometimes the Act of the Sheriff upon this Writ. But it frequently ſignifies the Eſtimate or Valuation of Lands, which, when done to the utmoſt Value, was ſaid to be in the full *Extent*.

EXTERGENT *Remedies*: See *Abſtergent*.

EXTERIOR *Polygon*: See *Polygon Exterior*.

EXTERIOR *Talus*: See *Talus*.

EXTERNAL *Angles*; See *Angles external*.

EXTERNUS *Auris*, *vel Luxator externus*, is a Muſcle which lies in the upper part of the *Meatus Auditorius*, having a ſhort fleſhy Body, with a long ſlender Tendon. It ariſes from the external and ſuperior Margin of the *Meatus Auditorius*, ſoon becoming a ſlender Tendon, paſſes directly to the upper part of the *Membrana Tympani*, on which it deſcends for ſome ſpace to its Inſertion in the long Proceſs of the *Malleus*, where it is contiguous to the ſaid Membrane. This draws the *Manubrium* of the *Malleus*, together with the *Membrani Tympani*, forwards. *L.*

EXTINCTION [in *Chymiſtry*, &c.] is when a Metal, Mineral, *&c.* has been heated red hot in the Fire, and afterwards is plunged into ſome Fluid to ſoften and temper its Acrimony; or to communicate its Vertue to the Liquor; or to give it a Temper, as the putting Steel into Water, *&c.*

EXTINGUISHMENT [in *Law*,] is an Effect of Conſolidation; as if a Man have a yearly Rent due to him out of any Lands, and afterwards purchaſe the ſame Lands; now both the Property and Rent are conſolidated or united into one Poſſeſſor, and therefore the Rent is ſaid to be *extinguiſhed*. Alſo, where a Man hath a Leaſe for Years, and afterwards buyeth the Property; this is a Conſolidation of the Property and the Fruits, and is an *Extinguiſhment* of the Leaſe. So if a Man have a Highway Appendant, and after purchaſe the Land whereon the Highway is, then the Highway is *extinct*; and ſo it is of Common Appendant.

EXTIRPATIONE, is a Writ Judicial that lieth againſt him, who, after a Verdict found againſt him for Land, *&c.* doth maliciouſly overthrow any Houſe upon it, *&c.* And 'tis either *ante Judicium*, or *poſt Judicium*. L.

EXTIRPATION, is the cutting off, or out of the Body any Part; tho' cutting off a Part is more properly called *Amputation*.

EXTORTION, a *Law Term*, ſignifying an unlawful or violent wringing of Money, or Money-worth from any Man: As alſo, the Exaction of unlawful Uſury, winning by unlawful Games, and all taking more than is due.

EXTRACT, is that pure, unmix'd, and efficacious Subſtance, which, by the help of ſome Liquor, is ſeparated from the duller and more unactive parts of Plants, *&c.* This Extract is uſually of the Conſiſtence of a ſtiff Electuary. All Extracts of Vegetables, are made after the following manner.

Bruiſe the Body, or powder it groſly, and then let it ſteep warm a convenient while in ſome proper Water, as from 12 Hours a Day, *&c.* according to the Nature of the Plant; at leaſt, let the Liquor juſt boil, and then preſs it hot thro' a Cloth; after this evaporate the filtered Liquor to its due Conſiſtence.

Thus are the Extracts of *Rhubarb*, *Gentian*, *Wormwood*, &c. made.

EXTRA *Judicial* [in *Law*,] is when Judgment is given in a Cauſe or Caſe not depending in that Court where ſuch Judgment is given, or wherein the Judge has not Juriſdiction.

EXTRACTION, is a ſeparating of the ſubtle Part of a mixed Body, from the more groſs: For *Example*, when the Strength of any Medicine is extracted by Spirit of Wine, that which is left after the Evaporation of the *Menſtruum*, is called the *Extract*.

EXTRACTION of *Roots*, in *Mathematicks*, is the Method of finding out the true Root of any Number or Quantity given: See *Square Root*, *Cube Root*, &c.

In Philoſ. Tranſ. N°.240. *the ingenious Mr.* Abr. de Moivre *gives the following Method of extracting the Root of an infinite Equation.*

THEOREM.

If $az + bz^2 + cz^3 + dz^4 + ez^5 + fz^6$, *&c.* $= gy + hy^2 + iy^3 + ky^4 + ly^5 + my^6$, *&c.*

Then will z be $= \frac{g}{a}y + \frac{h - bAA}{a}y^2 + \frac{i - 2bAB - cA^3}{a}y^3 + \frac{k - bB^2 - 2bAC - 3cA^2B - dA^4}{a}y^4 + \frac{l - 2bBC - 2bAD - 3cAB^2 - 3cA^2C - 4dA^3B - eA^5}{a}y^5 + \frac{m - 2bBD - bCC - 2bAE - cB^3 - 6cABC - 3cA^2D - 6dA^2B^2 - 4dA^3C - 5eA^4B - fA^6}{a}y^6$, &c.

For the underſtanding of this Series, and in order to continue it as far as we pleaſe, it is to be obſerved,

1. That every Capital Letter is equal to the Coefficient of each preceding Term: Thus, the Letter B is equal to the Coefficient $\frac{h - bA^2}{a}$.

2. That the Denominator of each Coefficient is always a.

3. That the firſt Member of each Numerator, is always a Coefficient of the Series $gy + hy^2 + iy^3$, &c. *viz.* The firſt Numerator begins with the Coefficient g, the ſecond Numerator with the ſecond Coefficient h, and ſo on.

4. That in every Member after the firſt, the Sum of the Exponents of the Capital Letters is always equal to the Index of the Power to which this Member belongs: Thus, conſidering the Coefficient $\frac{k - bB^2 - 2bAC - 3cA^2B - dA^4}{a}$ which belongs to the Power y^4, we ſhall ſee that in every Member bB^2, $2bAC$, $3cA^2Bd$, A^4 the Sum of the Exponent of the Capital Letters is 4. (Where it may be taken notice of, that by the Exponent of a Letter, is meant the Number which expreſſes what Place it has in the Alphabet: Thus 4 is the Exponent of the Letter D.) Hence is derived this Rule for finding the Capital Letters of all the Members that belong to any Power.

> *Combine the Capital Letters as often as you can make the Sum of the Exponents equal to the Index of the Powers to which they belong.*

5. That the Exponents of the ſame Letters which are written before the Capitals, expreſs how many Capitals there are in each Member.

6. That the Numeral Figures or *Unciæ* that occur in theſe Members, expreſs the number of Permutations, which the Capital Letters of each Member are capable of.

For the Demonſtration of this,

Suppoſe $z = Ay + By^2 + Cy^3 + Dy^4$, &c. Subſtitute this Series in the room of z, and the Powers of this Series in the room of the Powers of z; there will ariſe a new Series: Then take the Coefficients which belong to the ſeveral Powers of y, in this new Series, and make them equal to the correſponding Coefficients of the Series $gy + hy^2 + iy^3$, &c. and the Coefficients A, B, C, D, &c. will be found much as is determined in the *Theorem.*

This *Theorem* might have been made much more general, by ſuppoſing

$az^{n} + bz^{n+1} + cz^{n+2}$, &c. $= gy^{m} + hy^{m+1} + iy^{m+2}$, &c. Then all the Powers of the Series $Ay + By^2 + Cy^3$, &c. deſigned by the univerſal Indices, muſt have been taken ſucceſſively.

This *Theorem* may be applied to what is called *the Reverſion of Series*; ſuch as finding the *Number* from its *Logarithm* given; the *Sine* from its *Ark*; the *Ordinate* of an Ellipſis from an *Area*, given to be cut from any Point in the Axis.

But to make a particular Application of it, we'll ſuppoſe this Problem was to be ſolved, *viz.* The Chord of an *Ark* being given, to find the Chord of another *Ark* that ſhall be to the firſt as n to 1.

Let y be the Chord given, z the Chord requir'd: Now the *Ark* belonging to the Chord y, is $y + \frac{y^3}{6dd} + \frac{3y^5}{40d^4} + \frac{5y^7}{112d^6} +$, &c. and the Ark belonging to the Chord z, is $Z + \frac{z^3}{6d^2} + \frac{3z^5}{40d^4} + \frac{5z^7}{112d^6}$, &c. The firſt of theſe *Arks* is to the ſecond, as 1 to n; therefore multiplying the Extremes and Means together, we ſhall have this Equation, $Z + \frac{z^3}{6d^2} + \frac{3z^5}{40d^4} + \frac{5z^7}{112d^6}$, &c. $= ny + \frac{ny^3}{6d^2} + \frac{3ny^5}{40d^4} + \frac{5ny^7}{112d^6}$, &c.

Compare theſe two Series with the two Series of the *Theorem*, and you'll find $a = 1$, $b = 0$, $c = \frac{1}{6d^2}$, $d = 0$, $e = \frac{3}{40d^4}$, $f = 0$, $g = n$, $h = 0$, $i = \frac{n}{6d^2}$, $k = 0$, $l = -\frac{3n}{40d^4}$, $m = 0$, &c.

Hence $z = ny + \frac{n - n^3}{6d^2}y^3$, &c. Or $ny + \frac{1 - n^2}{2 \times 3d^2}y^2A$, &c. ſuppoſing A to denote the whole preceeding Term, which will be the ſame Series as Sir *Iſaac Newton* has firſt found.

On the ſame Method this general Problem may be ſolved.

The *Abſciſſa* correſponding to a certain *Area* in any Curve being given, to find the *Abſciſſa*, whoſe correſponding *Area* ſhall be to the firſt in a given *Ratio.*

The logarithmetick Series might alſo be found, without borrowing any other Idea, than that *Logarithms* are the *Indices* of Powers.

Let the Number, whoſe *Logarithm* we enquire, be $1 + z$; ſuppoſe its *Logarithm* to be $az + bz^2 + cz^3$, &c.

Let there be another Number $1 + y$: Therefore its *Logarithm* will be $ay + by^2 + cy^3$, &c.

Now if $1 + z = \overline{1 + y}^{\,n}$, it follows,

That $az + bz^2 + cz^3$, &c. $: ay + by^2 + cy^3$, &c. $:: n : 1$.

That is, $az + bz^2 + cz^3$, &c. $= nay + nby^2 + ncy^3$, &c.

Therefore we may find the Value of z, expreſt by the Powers of y.

Again, ſince $1 + z = \overline{1 + y}^{\,n}$; therefore $z = \overline{1 + y}^{\,n} - 1$.

That is, $z = ny + \frac{n}{1} \times \frac{n-1}{2}y^2 + \frac{n}{1} \times \frac{n-1}{2} \times \frac{n-2}{3}y^3$, &c.

Therefore z is doubly expreſt by the Power of y: Compare theſe two Values together, and the Coefficients a, b, c, &c. will be determined, except the firſt (a) which may be taken at Pleaſure, and gives accordingly all the different Species of *Logarithms.*

The following Converging Series for the Extracting of the Roots *of all* Equations, *whether Simple or Adfected, the late Mr.* Waſtel *of the* Navy-Office *ſent me, and deſired me to Publiſh.*

Let $\begin{cases} A = \text{to any Abſolute Number.} \\ N = \text{to any Number aſſumed.} \\ n = \text{to the Exponent of any Power.} \\ I, p, q, r, s, \&c. \text{ the ſeveral Coefficients in any Equation.} \end{cases}$

Then, in any Equation, it will be

$$\pm 1 \times x^{n} \pm p \times x^{n-1} \pm q \times x^{n-2} \pm r \times x^{n-3} \pm s, \&c. = A.$$

And we have univerſally,

$$x = \frac{A \pm 1 \times n-1\, N^{n} \pm p \times n-2\, N^{n-1} \pm q \times n-3\, N^{n-2} \pm r \times n-4\, N^{n-3} \pm, \&c.}{\pm 1 \times N^{n-1} \pm p \times n-1\, N^{n-2} \pm q \times n-2\, N^{n-3} \pm r \times n-3\, N^{n-4} \pm, \&c.}$$

In which Series obſerve,

I. That the ſame Sign in the given Equation, muſt be in the *Theorem* or *Series* reſpectively.

II. Any Term which is wanting in the Equation, muſt be omitted in the Series.

III. The Quotient at every Operation muſt be made a new N.

IV. That it terminates in the Root, or falls into a Series, if it be a *Surd.*

V. Such Series will be produced (in Number of Places) by a Geometrical Progreſſion from Unity, (whoſe Ratio is two) each Operation.

VI. The nearer N is taken to the true Root, the ſooner it will converge to it.

And in his Edition of *Parſon's Arithmetick, Book* 2. *Chap.* 21. you may ſee a further Account of this Series, and the ſame exemplified in Numbers.

Mr. *Ralphſon's* Method in raiſing particular Theorems for extracting the Roots of all Equations whatſoever, is as follows, *viz.* He ſuppoſes the Root in any Equation to be equal to a Binomial of a, a known, and y an unknown Quantity; and then ſubſtitutes the ſaid Binomial $a+y$, and its reſpective Powers for x, the Root, and its reſpective Powers in the given Equation, and then rejects (or leaves out) all the Members of the new Equation wherein there is any of the Power of y (exceeding the Root) and with the other Members makes a ſuppoſed Equation, and thereby finds the ſuppoſed value of y the conveying Part; which value of y, will be affirmative, if the Quantity a was taken leſs than the Root or Value of x, and therefore to be added to the Quantity a, which Sum will be a new Value of a; but if the Value of a was taken greater than the Root or Value of x, the Quantity y will be negative, and therefore to be ſubſtracted from the Value of a, and the remainder will be a new Value of a equal to x.

The Theorem for extracting the Root of a Quadratick Equation is formed thus:

Example I.

Let $x^2 = 2$ be a ſimple Quadratick, whoſe Root x is required,

Let $\begin{cases} a+y=x \\ b=2 \end{cases}$

Then will $a^2 + 2ay + y^2 = x^2 = b$.

And if y^2 be rejected, the Equation will be $a^2 + 2ay = b$ whence

$y = \frac{b-a^2}{2a}$ the Theorem for extracting the Root of the given Equation.

Suppoſe $a = 1$

Then will $a^2 = 1$

Then by the Theorem $\frac{b-a^2}{2a} = 2-1 \div 2 = 0,5 = y$ which being affirmative muſt be added to a, for a new Value of a.

Hence $1 + 0,5 = 1,5 = a$,

Then $a^2 = 2,25$

$2a = 3$

Therefore repeating the Theorem $\frac{b-a^2}{2a} = 2-2,25 = -0,25 \div 3 = -0,083$, which being negative muſt be ſubſtracted from the laſt Value of a,

Thus, $1,5 - 0,083 = 1,417 = a$, a new Value of a, for a third Operation.

$a = 1,417$

$a^2 = 2,007889$

$2a = 2,834$

Then repeating the Theorem $\frac{b-a^2}{2a} = 2-2,007889 \div 2,834 = -0,002783 = y$ which being Negative muſt be ſubſtracted from the laſt Value of a, Thus, $1,4117 - 0,002783 = 1,414217 = x$ the Root required, but if the Value of x were more accurately required, this Value of x would become a new Value of a; and after this Method you may proceed till you come infinitely near the Truth.

The Theorem for extracting the Cube-Root may be raiſed thus,

Example II.

If $x^3 = 13 = b$

And $x = a + y$

Then will $a^3 + 3a^2y + 3ay^2 + y^3 = x^3 = b$, and by rejecting $+3ay^2 + y^3$ the Equation will ſtand thus,

$$a^3 + 3a^2y = b.$$

whence $y = \frac{b - a^3}{3a^2}$ = the Theorem for extracting the Cube Root.

Suppoſe $a = 2,3$

Then will $a^3 = 12,167$

And $3a^2 = 15,87$

And by the Theorem

$\frac{b-a^3}{3a^2} = 13 - 12,167 \div 15,87 = 0,05 = y$, which being affirmative muſt be added to a, that is, $2,3 + 0,05 = 2,35 =$ to a new Value of a,

Then $a^3 = 12,977875$

And $3a^2 = 16,5675$

And by repeating the Theorem

$\frac{b-a^3}{3a^2} = 13 - 12,977875 \div 16,5675 = 0,001333 = y$, the ſecond approach, which added to the firſt approach, or the laſt Value of a, is $2,35, + 0,001333 = 2,351333$, the Cube Root of 13 very near, and done with near 200 Figures fewer than in the common way of Extraction.

To make the *Theorem* for reſolving an affected Cubick Equation.

Let the given Cubick Equation be

$x^3 + 13x^2 - 10x = 400 = b =$ to $x^3 + cx^2 - dx = b$

Let $a + y = x$

$$\text{Then} \begin{cases} a^3 + 3a^2y + 3ay^2 + y^3 = x^3 \\ ca^2 + 2cay + cy^2 = cx^2 \\ -da - yd = -dx \end{cases}$$

That is,

$a^3 + 3a^2y + 3ay^2 + y^3 + ca^2 + 2cay + cy^2 - da - dy = b$ and by rejecting every Step in which any Power of y is above the Root, the following Equation will remain, *viz.* $a^3 + 3a^2y + ca^2 + 2acy - da - dy = b$, whence $y = \frac{b - a^3 - ca^2 + da}{3a^2 + 2ac - d}$ which is the Theorem for finding the Value of y.

Let us take $a = 4$, then $-a^3 = -64$

$-ca^2 = -208$

which added makes -272

And $+b = +400$

$+da = +40$

Sum is $+440$

Then from $+440$

Subſtract -272

Remains $+168$ for a Dividend.

$+3a^2 = +48$

$+2ac = +104$

Sum is $+152$

Subſtract $-d = 10$

Remains $+142$ for a Diviſor.

Then 168 being divided by 142, the Quotient is 1, that is, $y = 1$, which being affirmative, muſt be added to a, which was 4, and it will become $a = 4 + 1 = 5$.

And to know whether 5 be one of the Roots of the given Cubic Equation, make $x = 5$, and by Tranſpoſition $x - 5 = 0$, and then divide the given Equation by $x - 5$.

Thus,

$$\begin{array}{l} x-5)\ x^3 + 13x^2 - 10x - 400\ (x^2 + 18x + 80 \\ \quad x^3 - 5x^2 \\ \hline \quad\quad 18x^2 - 10x \\ \quad\quad 18x^2 - 90x \\ \hline \quad\quad\quad +80x - 400 \\ \quad\quad\quad +80x - 400 \\ \hline \quad\quad\quad\quad 0 \end{array}$$

And the Quotient gives this Quadratic Equation $x_2 + 18x = -80$, which reſolved by the Rules in the preceeding Section, the Roots of it will be found to be -10 and -8; therefore the three Roots of the given Cubic Equation are $+5, -10, -8$, either of which, and its reſpective Powers, being ſubſtituted inſtead of x, and its Powers, will bring the given Equation to nothing, therefore thoſe Numbers are the Roots required.

But if there had been any remainder, when the given Cubic was divided by $x - 5$, then in that Caſe, 5 would not have been one of the Roots of the given Equation, and then a muſt have been made equal to 5, and by the Theorem a new Value of y might have been found; as in the following Examples.

Example I.

Let $x^3 - 7x^2 - 220x = 800 = x^3 - cx^2 - dx = b$, be the given Equation whoſe Roots are required:

Suppoſe as before, $a + y = x$

$$\text{Then} \begin{cases} a^3 + 3a^2y + 3ay^2 + y^3 = x^3 \\ -ca^2 - 2cay - cy^2 = cx^2 \\ -da - dy = -dx \end{cases}$$

That is,

$a^3 + 3a^2y + 3ay^2 + y^3 - ca^2 - 2cay - cy^2 - da - dy = b$ and by leaving out all the Quantities, in which any of the Powers above the Root of y are found, the Equation will ſtand,

Thus, $a^3 + 3a^2y - ca^2 - 2cay - da - dy = b$; whence $y = \frac{b - a^3 + ca^2 + da}{3a^2 - 2ca - d}$ the *Theorem* for finding the Value of y.

Suppoſe $a = 16$

Then $-a^3 = -4096$

$+b = 800$

$+ca^2 = 1792$

$+da = 3520$

Sum poſitive, 6112

Subſtract -4096

Dividend $+2016$

$+3a^2 = 768$

$-2ac = -224$

$-d = -220$

Sum negative, -444

From $+3a^2 = 768$
Subſtract -444

Remains for a Diviſor, $+324$

Then 2016 divided by 324 the Quotient, is $6 = y$; which being affirmative, muſt be added to 16, the Value of a; the Sum is 22, for a new Value of a; for by tryal it will be found, that 22 is none of the Roots of the given Equation: Therefore to repeat the Theorem,

$+3a^2 = 1452$

$-2ac = -308$
$-d = -220$

Sum of the negative, -528
Subſtract from 1452

For a Diviſor, 924

$a = 22$

$-a^3 = -10648$

$+b = 800$
$+ca^2 = 3388$
$+da = 4840$

Sum of the poſitive, 9028
Subſtract -10648

For a Dividend, -1620

Then -1620 divided by $+924$, gives $-1 = y$ for the Quotient, which being negative, muſt be ſubſtracted from 22, the former Value of a, and there remains 21 for a new Value of a: And to repeat the Theorem,

$+3a^2 = 1323$

$-2ca = -294$
$-d = -220$

Sum of the negative, -514
Subſtracted from 1323

Diviſor, 809

$a = 21$
$-a^3 = -9261$

$+b = 800$
$+ca^2 = 3087$
$+da = 4620$

Sum of the $+8507$
Subſtract -9261

Remains for a Divid. -754

And by dividing -754 by 809, the Quotient will be almoſt $-1 = y$; which being negative, is to be ſubſtracted from 21, the laſt Value of a; and here it is to be obſerved, that tho' the Diviſion of -754 by 809, does not amount to one, yet it is to be taken as ſuch, in order to make a tryal, that it may be diſcovered whether the Root required be a whole Number or Fraction.

Thus, $21 - 1 = 20 = x$

Then by dividing the given Equation, $x^3 - 7x^2 - 22x - 800 = 0$ by $x - 20$, the Quotient will be $x^2 + 13x + 40 = 0$, and the Roots of this Quadratic Equation will be found -5 and 8; therefore the Roots of the given Cubic Equation are 20, -5, -8.

Example II.

Let it be required to find one of the affirmative Values of x, in this adfected Cubic Equation.

$$x^3 + 438x^2 - 7825x - 98508430 = 0$$
$$= x^3 + cx^2 - dx = b$$

The Theorem raiſed, as in the preceeding Examples, is $y = \frac{b - a^3 - ca^2 + da}{3a^2 + 2ca - d}$

Suppoſe $a = 300$
$+3a^2 = 270000$
$+2ca = 362800$

Sum is $= 632800$
Subſtract -7825

Remains for a Diviſor, 624975

Then $-a^3 = -27000000$
$-ca^2 = -39420000$

Sum -66420000

$+b = 98508430$
$+da = 2347500$

Sum 100855930
Subſtract -66420000

For a Dividend, 34435930

Then 34435930 divided by 624975, gives $55 = y$ in the Quotient, which being affirmative, muſt be added to 300, the firſt Value of a, which gives 355 equal to the ſecond Value of a; and by repeating the Theorem ſeveral times, $a + y$ will be found to be $356,97089681 = x$, the Root required, very near.

Example III.

Let one of the affirmative Values of x, be required in this Biquadratic Equation, *viz.*

$$x^4 - 80x^3 + 1998x^2 - 14937x = -5000 = x^4 - cx^3 + dx^2 - ex = -b.$$

To form the Theorem

Suppoſe $a + y = x$

$$a^4 + 4a^3y + 6a^2y^2 + 4ay^3 + y^4 = x^4$$
$$-ca^3 - 3ca^2y - 3cay^2 - cy^3 = -cx^3$$
$$+da^2 + 2day + dy^2 = dx^2$$
$$-ea - ey = ex$$

And by leaving out all the Quantities, in which any of the Powers of y are found above its Root, the Sum of the reſt will ſtand thus:

$$a^4 + 4a^3y - ca^3 - 3ca^2y + da^2 + 2day - ea - ey = -b$$

whence $y = \frac{-b - a^4 + ca^3 - da^2 + ea}{4a^3 - 3ca^2 + 2da - e}$ The Theorem for finding the Value of y.

Let us ſuppoſe $a = 12$
$4a^3 = 6912$
$2da = 47952$

Sum poſitive 54864

$-3ca^2 = -34560$
$-e = -14937$

Sum negative, -49497

From poſitive 54864
Subſtract negative 49497

Remains for a Diviſor, 5367

$-5000 = -b$
$-20736 = -a^4$
$-287712 = -da^2$

-313448 Sum negative.

$138240 = +ca^3$
$179244 = +ea$

$317484 =$ Sum poſitive.
-313448 Sum negative ſubſt.

Remains + 4036 for a Dividend.

Then dividing 4036 by 5367, the Quotient is 0, 7, which being poſitive, muſt be added to the former Value of a, *viz.* $12+0{,}7=a$: Then to find a new Value of y, the Theorem muſt be repeated:

Thus, $a = 12{,}7$

$-b = -5000$
$-a^4 = -25614{,}4641$
$-da^2 = -322257{,}42$

Sum negative $-352871{,}8841$

$+ca^3 = 163870,\ 640$
$+ea = 189699,\ 9$

Sum poſitive, 353570, 540
Subſtract the negative, 352871, 8841

Remains the Dividend, 698, 6559

$+4a^3 = 8193{,}532$
$+2da = 40649{,}2$

Sum poſitive, 48842,732

$-3ca^2 = -38709{,}160$
$-e = -14937$

Sum negative, —53646,160
Subſtract poſitive, 48842,732

Remains for a Diviſor, — 4803,428

Then 698,6559 being divided by — 4803,428, the Quotient will be —, 0145, which being negative, muſt be ſubſtracted from 12,7 the laſt Value of a, and the Remainder is 12,6855 for the Value of x, very near.

After the ſame manner, Theorems may be formed to find the Roots of Equations of the fifth or ſixth Power, or of any given Power; for the Theorem for the fifth Power will be

$$y = \frac{\pm b \pm a^5 \pm ca^4 \pm da^3 \pm ea^2 \pm fa}{5a^4 \pm 4ca^3 \pm 3da^2 \pm ea \pm f}$$

And for the ſixth Power the Theorem is

$$y = \frac{\pm b \pm a^6 \pm ca^5 \pm da^4 \pm ca^3 \pm fa^2 \pm ga}{a^5 \pm 5ca^4 \pm 4da^3 \pm 3ea^2 \pm 2fa \pm g}$$

And for any other Power Theorems may be formed.

And it is to be obſerv'd, That the Signs of thoſe Quantities of the Theorem that are above the Line, each reſpectively is the reverſe of the Signs in the given Equation; and the Signs of the Quantities of the Theorem below the Line, are the ſame with the Signs of the given Equation for which the Theorem is made.

The famous Dr. *Hally* found two univerſal Theorems for Evolving Equations, the one rational, the other irrational, which converge faſter than thoſe of Mr. *Ralphſon's* Theorem, for every renewal of each of Dr. *Hally's* Theorems, triples the true Figures in the value of a, but thoſe Theorems of Mr. *Ralphſon's* are eaſier for the Learner to begin with, and when once the Learner underſtands thoſe of Mr. *Ralphſon's*, Dr. *Hally's* will be equally eaſy; and is as follows, *viz.*

Let z, the Root of any Equation, be imagin'd to be compos'd of the parts $a+$, or $-e$, of which let a be aſſum'd as near z as is poſſible; which is notwithſtanding not neceſſary, but only commodious; then from the Quantity $a+e$, or $a-e$, let there be form'd all the Powers of z, found in the Equation, and the numerical Coefficients be reſpectively affix'd to them; then let the Power to be reſolved be ſuſtracted from the Sum of the given parts (in the firſt Column where e is not found) which they call *Homogeneum Comparationis*, and let the difference be $\pm b$. In the next place, take the Sum of all the Coefficients of e in the ſecond Column, which put $=s$; laſtly, in the third Column, let there be put down the Sum of all the Coefficients of ee, which Sum call t, then will the Root z ſtand thus in the rational *Formula, viz.* $z = a + \frac{sb}{ss \pm tb}$; and thus in the irrational *Formula, viz.* $z = a \pm \frac{\frac{1}{2}s \mp \sqrt{\frac{ss}{4} \mp bt}}{t}$ which perhaps it may be worth while to illuſtrate by ſome Examples; and inſtead of an Inſtrument let this Table ſerve, which ſhews the Geneſis of the ſeveral Powers of $a \pm e$, and, if need be, may eaſily be continued farther; which, for its uſe, I may rightly call a *General Analytical Speculum*, the forementioned Powers ariſing from a continual Multiplication by $a+e\ (=z)$ comes out thus with their adjoin'd Coefficients.

Tabula Poteſtatum.

$$\begin{array}{lllllllll}
 & & s & t & u & w & x & y & \\
lz^7 = & la^7 & +7la^6e & +21la^5ee & +35la^4e^3 & +35la^3e^4 & +21la^2e^5 & +7lae^6 & +le^7 \\
kz^6 = & ka^6 & +6ka^5e & +15ka^4ee & +20ka^3e^3 & +15ka^2e^4 & +6kae^5 & +ke^6 & \\
hz^5 = & ha^5 & +5ha^4e & +10ha^3ee & +10ha^2e^3 & +5hae^4 & +he^5 & & \\
gz^4 = & ga^4 & +4ga^3e & +6ga^2ee & +4gae^3 & +ge^4 & & & \\
fz^3 = & fa^3 & +3fa^2e & +3faee & +fe^3 & & & & \\
dz^2 = & da^2 & +2dae & +dee & & & & & \\
cz = & ca & +ce & & & & & &
\end{array}$$

But now, if it be $a - e = z$, the Table is compos'd of the ſame Members, only the odd Powers of e, as e, e^3, e^5, e^7, are negative, and the even Powers, as e^2, e^4, e^6, affirmative; alſo, let the Sum of the Coefficients of the Side be $= s$; the Sum of the Coefficients of the Square $ee = t$, the Sum of the Coefficients of $e^3 = u$, of $e^4 = w$, of $e^5 = x$, of $e^6 = y$, &c. But now, ſince e is ſuppos'd only a ſmall part of the Root that is to be enquir'd, all the powers of e will be much leſs than the Correſpondent Powers of a; and ſo for the firſt Hypotheſis; all the ſuperior ones may be rejected; and forming a new Equation, by ſubſtituting $a \pm e = z$, we ſhall have (as was ſaid) $\pm b = \pm se \pm tee$; the following Examples will make this more clear.

Example I.

Let the Equation $z^4 - 3z^2 + 75z = 10000$ be propos'd: For the firſt Hypotheſis, let $a = 10$; and ſo we have this Equation,

$$\begin{array}{lll}
z^4 = + a^4 & 4a^3 e + 6a^2 ee & 4ae^3 + e^4 \\
-dz^2 = -da^2 & 2dae - dee & \\
+cz = + ca & ce & \\
& & \\
= + 10000 & 4000e + 600ee & 40e^3 + e^4 \\
- \quad 300 & 60e - 3ee & \\
+ \quad 750 & 75e & \\
- 10000 & & \\
\hline
\end{array}$$

$$+ 450 - \underset{s}{4015e} + \underset{t}{597ee} - \underset{u}{40e^3} + e^4 = 0$$

The Signs + and —, with reſpect to the Quantities e and e^3, are left as dubious, till it be known whether e be negative or affirmative; which thing creates ſome Difficulty, ſince that in Equations that have ſeveral Roots, the *Homogenea Comparationis* (as they term them) are often times encreas'd by the minute Quantity a; and on the contrary, that being encreas'd, they are diminiſhed; but the Sign of e is determined from the Sign of the Quantity b; for taking away the Reſolvend from the *Homogeneal* form'd of a, the Sign of se (and conſequently of the prevailing parts in the Compoſition of it) will always be contrary to the Sign of the difference b; whence 'twill be plain, whether it muſt be $+ e$, or $- e$; and conſequently, whether a be taken greater or leſs than the true Root; now the Quantity e is $= \frac{1}{2} s - \frac{\sqrt{\frac{1}{4} ss - bt}}{t}$ when b and t have the ſame Sign; but when the Signs are different, e is $= \frac{\sqrt{\frac{1}{4} ss + bt}}{t} - \frac{1}{2} s$, but after it is found that it will be $- e$, let the Powers e, e^3, e^5, &c. in the affirmative Members of the Equation, be made negative, and in the negative be made affirmative; that is, let them be written with the contrary Sign on the other hand; if it be $+ e$, (let thoſe forementioned Powers) be made affirmative in the affirmative, and negative in the negative Members of the Equation.

Now we have in this Example of ours, 10450 inſtead of the Reſolvend 10000, or $b = + 450$; whence it's plain, that a is taken greater than the truth, and conſequently, that 'tis $- e$: Hence the Equation comes to be,
$10450 - 4015e + 597ee - 4e^3 + e^4 = 10000$, that is, $450 - 4015e + 597ee = 0$, and ſo $450 = 4015e - 597ee$, or $b = se - tee$ whoſe Root $e = \frac{1}{2} s - \frac{\sqrt{\frac{1}{4} ss - bt}}{t}$, or $\frac{s}{2t} - \sqrt{\frac{ss}{4tt} - \frac{b}{t}}$; that is in the preſent Caſe, $e = \frac{2007\frac{1}{2} - \sqrt{3761406\frac{1}{4}}}{597}$, from whence we have the Root ſought, 9,886, which is near the truth; but then ſubſtituting this for a ſecond Suppoſition, there comes $a + e = z$, moſt accurately, 9,8862603936495, ſcarce exceeding the truth by 2 in the laſt Figure, *viz.* when $\frac{\sqrt{\frac{1}{4} ss + bt}}{t} - \frac{1}{2} s = e$; and this (if need be) may be yet much farther verify'd, by ſubſtracting (if it be $+ e$) the Quantity $\frac{\frac{1}{2} ue^3 + \frac{1}{2} e^4}{\sqrt{\frac{1}{4} ss + tb}}$, from the Root before found; or (if it be $- e$) by adding $\frac{\frac{1}{2} ue^3 - \frac{1}{2} e^4}{\sqrt{\frac{1}{4} ss - tb}}$ to that Root; which Compendium is ſo much the more valuable, in that ſometimes from the firſt Suppoſition alone, but always from the Second, a Man may continue the *Calculus* (keeping the ſame Coefficients) as far as he pleaſes: It may be noted, that the forementioned Equation has alſo a negative Root, *viz.* $z = 10,26$, which any one that has a mind, may determine more accurately.

Example II.

Suppoſe $z^3 - 17z^2 + 54z = 350$, and let $a = 10$: Then according to the Preſcript of the Rule,

$$\begin{array}{l}
+z^3 = a^3 + 3a^2 e + 3ae^2 + e^3 \\
-dz^2 = -da^2 - 2dae - de^2 \\
+cz = ca + ce
\end{array}$$

That is,

$$\begin{array}{llll}
& b & s & t \\
+ & 1000 & + 300e & + 30e^2 + e^3 \\
- & 1700 & - 340e & - 17e^2 \\
+ & 540 & + 54e & \\
- & 350 & & \\
\hline
\end{array}$$

$$\text{or, } - 510 + 14e + 13e^2 + e^3 = 0$$

Now ſince we have $- 510$, it is plain, that a is aſſum'd leſs than the truth, and conſequently, that e is affirmative; and from (the Equation) $510 = 14e + 13e^2$, comes $e = \frac{\sqrt{bt + \frac{1}{4} ss} - \frac{1}{2} s}{t} = \frac{\sqrt{6679} - 7}{13}$, whence $z = 15,7..$, which is too much, becauſe of a taken wide; therefore, *ſecondly*, let $a = 15$, and by the like way of reaſoning we ſhall find $e = \frac{\frac{1}{2} s - \sqrt{\frac{1}{4} ss - tb}}{t} = \frac{109\frac{1}{2} - \sqrt{11710\frac{1}{4}}}{28}$, and conſequently, $z = 14,954068$: If the Operation were to be repeated the third time, the Root will be found conformable to the truth as far as the 25th Figure; but he that is contented with fewer, by writing $tb \pm te^3$ inſtead of tb; or ſubſtracting or adding $\frac{\frac{1}{2} e^3}{\sqrt{\frac{1}{4} ss + tb}}$ to the Root before found; will preſently obtain his End. *Note*, The Equation propos'd, is not explicable by any other Root, becauſe the Reſolvend 350, is greater than the Cube of $\frac{17}{3}$, or $\frac{d}{3}$.

Example III.

Let us take the Equation $z^4 - 80z^3 + 1998z^2 - 14937z + 5000 = 0$, which Dr. *Wallis* uſes, *Chap.* 62. of his Algebra, in the Reſolution of a very difficult Arithmetical Problem; where, by *Vieta*'s Method, he has obtain'd the Root moſt accurately; and Mr. *Ralphſon* brings it alſo, as an Example of his Method, *Page* 25, 26. Now this Equation is of the Form which may have ſeveral affirmative Roots, and (which increaſes the Difficulty) the Coefficients are very great in reſpect of the Reſolvend given.

But that it may be the eaſier manag'd, let it be divided, and according to the known Rules of Pointing, let $-z^4 + 8z^3 - 20z^2 + 15z = 0,5$ (where the Quantity z is $\frac{1}{10}$ of z in the Equation propos'd) and for the firſt Suppoſition, let $a = 1$, then $+2 - 5e - 2e^2 + 4e^3 - e^4 - 0,5 = 0$; that is, $1\frac{1}{2} = 5e + 2ee$; hence $e = \frac{\sqrt{\frac{1}{4}ss + bt} - \frac{1}{2}s}{t}$ is $= \frac{\sqrt{37} - 5}{4}$, and ſo $z = 1,27$; whence 'tis manifeſt, that 12,7 is near the true Root of the Equation propos'd. Now, *ſecondly*, let us ſuppoſe $z = 12,7$, and then, according to the directions of the Table of Powers, there ariſes

$$\begin{array}{llll}
-26014,4641 & -8193,532e & -967,74e^2 & -50,8e^3 - e^4 \\
+163870,640 & +38709,60\,e & +3048,\,e^2 & +80,\,e^3 \\
-322257,42 & -50749,2\,e & -1998,\,e^2 & \\
+189699,9 & +14937,\,e & & \\
-5000. & & & \\
\hline
+298,6559 & -5296,132e & +82,26e^2 & +29,2e^3 - e^4 = 0
\end{array}$$

And ſo $-298,6559 = -5296,132e + 82,26e^2$, whoſe Root e (according to the Rule) $= \frac{\frac{1}{2}s - \sqrt{\frac{1}{4}ss - bt}}{t}$ comes to $\frac{2648,066 - \sqrt{6987686,106022}}{82,26} = ,05644080331\ldots = e$ leſs than the truth, but that it may be corrected, 'tis to be conſidered, that $\frac{\frac{1}{2}ue^3 - \frac{1}{2}e^4}{\sqrt{\frac{1}{4}ss - bt}}$, or $\frac{,0026201}{2643,423}$ is ,00000099, and conſequently e corrected, is $= 0564470448$, and if you deſire yet more Figures of the Root, from the e corrected, let there be made $tue^3 - te^4 = 0,43105602423$ and $\frac{\frac{1}{2}s - \sqrt{\frac{1}{4}ss - bt - tue^3 + te^4}}{t}$

or which is all one

$\frac{2648,066 - \sqrt{6987685,67496597577}}{82,26} = ,05644179448074402 = e$; whence $a + e = z$ the Root is moſt accurately 12,75644179448074402, as Dr. *Wallis* found in the forementioned place; where it may be obſerv'd, that the repetition of the *Calculus* does ever triple the true Figures in the aſſum'd a, which the firſt correction, or $\frac{\frac{1}{2}ue^3 - \frac{1}{2}e^4}{\sqrt{\frac{1}{4}ss - bt}}$ does quintuple, which is alſo commodiouſly done by the Logarithms, but the other Correction after the firſt, does alſo double the number of Figures, ſo that it renders the aſſum'd altogether ſevenfold; yet the firſt correction is abundantly ſufficient for arithmetical Uſes, for the moſt part.

But as to what is ſaid concerning the number of Places rightly taken in the Root, I would be underſtood ſo, that when a is but $\frac{1}{10}$ part diſtant from the true Root, then the firſt Figure is rightly aſſum'd; if it be within $\frac{1}{100}$ part, then the two firſt Figures are rightly aſſum'd; if within $\frac{1}{1000}$ part, then the three firſt Figures are ſo; which conſequently, manag'd according to our Rule, do preſently become nine Figures.

It remains now that I add ſomething concerning our *Rational Formula, viz.* $e = \frac{sb}{ss \pm tb}$, which ſeems expeditious enough, and is not much inferior to the former, ſince it will triple the given number of Places.

Now, having form'd an Equation from $a \pm e = z$, as before, it will preſently appear, whether a be taken greater or leſſer than the truth; ſince se ought always to have a Sign contrary to the Sign of the Difference of the Reſolvend, and its Homogeneal produced from a; then ſuppoſing $+b + se + a - tee = 0$ the Diviſor is $ss - tb$; as often as t and b have the ſame Signs; but it is $ss + bt$, when they have different ones, but it ſeems moſt commodious for Practice, to write the Theorem thus, $e = \frac{b}{s} + \frac{tb}{s}$, ſince this way the Thing is done by one *Multiplication* and two *Diviſions*, which otherwiſe would require three *Multiplications*, and one *Diviſion*.

Let us take now one Example of this Method, from the Root (of the forementioned Equation) 12,7, where $\underset{+b}{298,6559} - \underset{-s}{5296,132}e + \underset{+t}{82,26}ee + \underset{+u}{29,2}e^3 - e^4 = 0$, and ſo $\frac{b}{s} - \frac{tb}{s} = e$; that is, let it be as s to t, ſo b to $\frac{tb}{s} =$ 5296,132) 298,6259 into 82,26 (4,63875, wherefore the Diviſor is $s - \frac{tb}{s} = 5291,49325\ldots$) 298,6559 (0,056441 $= e$, that is, to five true Figures added to the Root that was taken; but this *Formula* cannot be corrected, as the foregoing irrational one was; and ſo if more Figures of the Root are deſired, 'tis the beſt to make a new Suppoſition, to repeat the *Calculus* again; and then a new Quotient, tripling the known Figures of the Root, will abundantly ſatisfy even the moſt ſcrupulous, &c.

EXTRACTION [in *Surgery*,] an Operation, whereby ſome foreign Matter that has been formed in the Body, contrary to the order of Nature, is drawn out of it.

EXTRAMUNDANE *Space*, is the infinite, empty, void Space, which is by ſome ſuppoſed to be extended beyond the Bounds of the Univerſe, and conſequently, in which there is really nothing at all.

EXTRAVASATED [in *Anatomy*] is whatever is put or let forth out of the Veſſels, as Blood out of the Veins or Arteries, into the Cavities of the Body, &c.

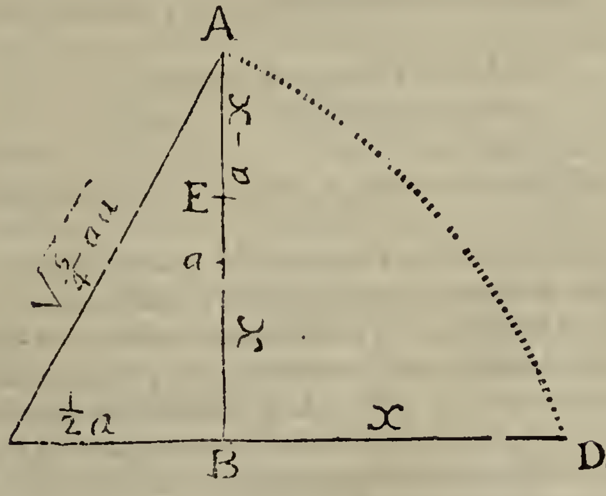
EXTRAVASATION [with *Phyſicians*,] the Motion or Action whereby the Blood breaks out of its ordinary Veſſels the Veins and Arteries, and gathers and ſtagnates in ſome part of the Body.

EXTREME *and mean Proportion*, in *Geometry*, is when a Line is ſo divided, that the whole Line is to the greater Segment, as that Segment is to the other.

Or, as *Euclid* expreſſes it, when 'tis ſo divided, that the Rectangle under the whole Line, and the leſſer Segment, ſhall be equal to the Square of the greater Segment.

The Invention whereof is as follows.

Let the given Line be $AB = a$, and for the greater Segment put x; the leſſer will be $a - x$.



Then by the Hypotheſis

$$a : x : a - x \div.$$

Therefore $aa - ax = xx$, conſequently $aa = ax + ax$.

And by adding $\frac{1}{4}aa$ on each Side, to make $xx + ax + \frac{1}{4}aa$ a compleat Square,

The Equation will ſtand thus,

$$\frac{5}{4}aa = xx + xa + \frac{1}{4}aa.$$

Now ſince the latter is exactly a Square, its Root $x + \frac{1}{2}a = \sqrt{\frac{5}{4}aa}$; and by Tranſpoſition it will be $\sqrt{\frac{5}{4}aa} - \frac{1}{2}a = x$; which laſt Equation is a Canon to find x.

For at the Foot of $AB = a$, ſet at Right Angles $CB = \frac{1}{2}a$: Then draw CA, the Square of which is equal $ABq + CBq = \frac{5}{4}aa$. And therefore $AC = \sqrt{\frac{5}{4}aa}$; make $CD = CA$.

From whence $CB = \frac{1}{2}a$ being taken as the Caſe requires, there remains $BD = x$; which transfer into AB, it ſhall find the Point E, where AB is cut according to *Extreme and Mean Proportion.*

The Synthetical Demonſtration *whereof*, Euclid *gives in the* 11. *E.* 2.

This cannot be done exactly in any Numbers; but if you would have it tollerably near, add together the Square of any Number, and the Square of its half, and extract as near as you can the Square Root of the Sum; from whence taking half the whole Number, the Remainder is the greater Part.

EXTREMITIES *of the Figures in Painting*, are the Head, Hands, and Feet; and theſe ſhould be drawn with more Nicety and Exactneſs, or more terminated than other Parts; and muſt help, by that means, to render the Action more expreſſive.

EXTUBERANCES, are Swellings forth, or Riſings up in the Fleſh, or other Parts of the Body.

EXULCERATION, is a Solution of Continuity, proceeding from ſome gnawing Matter, and in ſoft Parts of the Body is attended with a loſs of their Quantity; it differs from an *Abſciſſe* which commonly follows a *Criſis*.

EXUSTION [in *Surgery*] a burning by Fire. *L.*

EXUVIÆ, the Shells, and other Marine Bodies, which are found every where in the Bowels of the Earth, and which were certainly left there at the univerſal Deluge, becauſe they are now proved by Dr. *Woodward* and others, to be the real Spoils of once living Animals, and not Stones, or natural Foſſils; he very properly calls them the *Exuviæ* of Animals. *L.*

EYE, is the wonderful Organ of Sight. The Eyes are placed in two large Cavities, which they call *Orbitæ*, hollowed out of the Bones of the Skull on each ſide of the Noſe; which *Orbitæ* are inveſted on their inſide with their *Pericranium*, and to it the Feet and Origines of the Muſcles adhere firmly. Theſe are the firſt containing Part of the Eye; the next are the *Palpebræ*, or Eye-lids; which ſee under *Palpebræ.*

The Eye hath four Tunicles; of which one is called *Common*, and the other three *Proper.*

The *Common* Tunicle is called *Adnata*, and this ſprings from the *Pericranium*, and is ſpread over all the white of the Eye, above the *Sclerotica*, reaching as far as the *Iris*. By this the Eye is kept firmly within its Orbit, from whence it is alſo called *Conjunctiva.* It is of very exquiſite Senſe, and has many Capillary Veins and Arteries creeping through it, which are moſt conſpicuous in an *Opthalmy*, or Inflammation of the Eye. Under this Tunicle are Tendons of the Muſcles, extended and expanded to the Circumference of the *Iris*, which increaſes its Whiteneſs; and ſome take them for a ſecond Tunicle, calling it *Innominata.*

The *Proper* Tunicles of the Eye are three, according to the threefold Subſtance of the Optick-Nerve. For this Nerve (as all the other) conſiſts of two Tunicles ſpringing from this, the *Dura* and *Pia Mater*, and an inner marrowy Subſtance.

From the *Dura Mater* ſpringeth the utmoſt Coat of the Nerve; and from the Tunicle that is ſpread next under the *Adnata*, called *Sclerotica*, from its Hardneſs; but in its fore-part where it covereth the *Iris* and *Pupilla*, it is named *Cornea*, from its tranſparency, tho' ſometimes this latter Name includes the whole Tunicle, as well behind and on the Sides, as before.

That which lieth next under the *Cornea*, is much thinner than it, and is called *Choroides*, from its reſembling the Membrane *Chorion*, wherein the *Fœtus* is included in the Womb. Its forepart is otherwiſe called *Uvea*, becauſe it is ſomewhat of the Colour of a Grape. This ſprings from the *Pia Mater*, and is ſpread from the Bottom or Center of the Eye behind, all over the Eye to the *Pupilla*; to whoſe Circumference when it is come, it becomes double, making with one Part the *Iris*, with the other the *Ligamentum ciliare.*

On the inſide it is of a duſkiſh Colour, (in Man) but blacker on the outſide. But where it makes the *Iris*, it is of divers Colours, reſembling the Rainbow, from whence it borrows its Name: Yet in ſome it is more blue, in others black, in others grey.

This Tunicle is perforated before as wide as the *Pupilla*, (or Sight of the Eye) to permit the Rays of viſible Species to paſs into the Cryſtalline Humour.

Next unto which Cryſtalline Humour lies the *Ligamentum ciliare*, the ſecond Part of the duplicated *Uvea*. This conſiſts of ſlender Filaments, or Fibres, (like the Hairs of the Eye-lids) running like ſo many black Lines from the Circumference of the *Uvea* to the Sides of the Cryſtalline Humour, which they encompaſs and widen, or conſtringe as there is occaſion, by contracting or opening the *Foramen* of the *Uvea*.

The third Tunicle is made of the Medullar Subſtance of the Optick-Nerve, and is called *Retina*, or *Retiformis*, (Net-like:) This ſeemeth to be the principal Organ of Sight. For as Dr. *Briggs* well argues, neither the Cryſtalline Humour, through which the Rays paſs much refracted, nor the Tunicle *Choroides*, are at all fit for this Uſe: For this latter Part (as riſing from the *Pia Mater*) cannot communicate the Impreſſions of the Rays to the Medullar Part of the Brain, which it does not at all touch: Whereas the Medullar Fibres of the *Retina* have Communication therewith, as ſpringing therefrom, and therefore can well perform that Office. The Fibres of this Tunicle are extended from the Bottom or inner Center of the Eye, where the Optick Nerve enters it, as far as the *Ligamentum ciliare*, (to which it affords Animal Spirits for the Continuance of its Motion.) If one take this *Tunica Retina*, and put it into warm Water, ſhaking it a little, to waſh off the mucous Subſtance that cleaves to it, and then hold it up to the Light, theſe Filaments will appear very numerous, like the Threads of the fineſt Lawn.

Next to the Tunicles of the Eyes, are the Humours contained in them to be conſidered; and theſe are in Number Three, *viz.* *Aqueous*, *Cryſtallinus*, and *Vitreus*. The ſecond weighs as much again as the firſt, and yet not ſo much as the third by a ſixth Part. The Cryſtalline is the moſt denſe of Conſiſtence by much; and the glaſſy more denſe than the watry.

The *Aqueous* Humour is outermoſt, being pellucid and of no Colour, (as neither are the other two.) It fills up that Space that is betwixt the *Cornea* and the Cryſtalline Humour before. If any thickiſh Particles ſwim in it, then Gnats, Flies, Spiders-Webs, and the like, will ſeem to be flying before the Eyes: But if thoſe Particles grow ſtill thicker, and cloſe together, ſo as to make a Film, and this be ſpread before the Hole of the *Pupilla*, then is the Sight quite taken away, which Diſeaſe is call'd a *Cataract*.

This Humour is very clear and thin, and therefore eaſily diſſipable; but by which way its Expence is ſupplied, is difficult to determine. Some think it is fed by the Arteries, out of which this Water iſſues through I know not what Glands; others derive it from the Nerves, and a third Sort from the Lympheducts.

But Dr. *Anthony Nuck* refutes all theſe Opinions.

The firſt, from the Non-appearance of any Glands.

The ſecond, from the no (or at the moſt a very ſmall Quantity of) Liquor that at any time can be obſerved in the Nerves; whereas if the *Tunica cornea* be prick'd, and all, or the greateſt Part of this aqueous Humour be let out, he has found, by repeated Experiments, that it will be recruited again in ſix Hours Space.

The third Opinion he refutes from the general Office of Lympheducts; which is, to bring back from the Circumference to the Center, and not contrarily, becauſe the Valves wherewith they every where abound, cannot admit of that Motion. Wherefore exploding all theſe Opinions, he eſtabliſhes a new one of his own, upon the Score of the new Veſſels that he has obſerved to terminate in the *Tunica cornea*, (which he calls *Ductus Oculorum aquoſi*, which we ſhall deſcribe from him by and by) affirming, That theſe Ducts are the Conduits by which this Humour is fed; and that they ſupply it ordinarily with ſeveral Drops daily, becauſe of the continual Tranſpiration of it, by Pores looking from within outwards. As to the Particles of this Humour, from ſeveral Experiments he has made, he thinks it is demonſtrable:

1. That it contains in it a very limpid and pellucid Water.
2. Viſcid and Tenacious Particles.
3. A Salt and an Acid.
4. Earthy Particles.
5. That it wants not alſo its Volatile Spirit.

The *Cryſtalline Humour* (ſo called from its being as clearly tranſparent as Cryſtal) is placed betwixt the Aqueous and Vitreous, but not exactly in the Middle or Center of the Eye, but rather towards its Fore-part. It is incloſed in the Boſom, as it were, of the Vitreous Humour, and is flattiſh on the Fore-ſide, but rounder behind. It is more bright and thick than either of the other two.

It has been the common Opinion, That it has been incloſed in a proper Membrane, which is called either *Cryſtallina* from its Tranſparency, or *Aranea* from its moſt fine Contexture. But Dr. *Briggs*, a very accurate Anatomizer of the Eye, denies any ſuch Tunicle, affirming, That it is meerly adventitious when the Humour is expoſed for ſome time to the Air, or gently boil'd.

As to the Collection or Reception of the Rays of Things viſible, this Humour is the primary Inſtrument of Sight; tho', as was ſaid before, the *Tunica Retina* is the Principal as to Perception; becauſe through it the Rays are communicated to the common Senſory.

The third and laſt Humour of the Eye is the *Vitreous*, ſo called, becauſe it is the like to molten Glaſs. This is thicker than the Aqueous, but thinner than the Cryſtalline, and much exceeds them both in Quantity; for it fills up all the inner or hinder Hemiſphere of the Globe of the Eye, and a pretty deal towards the lateral Superficies of the former. It is round behind, but hollow in the middle forwards, to receive the Cryſtalline into its Boſom. This Humour is alſo ſaid to be ſeparated from the other two by a proper Tunicle called *Vitrea*, which the aforeſaid ingenious Author likewiſe denies.

The Eyes have Arteries from the *Carotides*, which beſtow Twigs on their Muſcles, and on their Tunicles; and theſe are accompanied with Veins ſpringing from the Branches of the Jugulars. As for their Nerves, they either aſſiſt the Senſe of Seeing, and are called the Optick Nerves, which we have reckon'd from the ſecond Pair; or ſerve for the moving of them, being inſerted into their Muſcles; and to this Purpoſe, ſerve the third and fourth Pair, as ſome Twigs of the fifth.

As to the Lympheducts, beſides theſe Veſſels, Dr. *Anthony Nuck*, whom we cited but juſt now, has diſcovered a fifth Sort of Veſſel, called by him, *Ductus Oculorum aquoſi*, which he believes to recruit the continual Conſumption of the watry Humour of the Eye.

He ſays, They are of an uncertain Number, and may be plainly diſcern'd to run along the *Tunica Sclerotica*, and to penetrate at length the *Cornea*; where their Orifices have ſuch a Valve as the Ureters have in their Urinary Bladder, or the *Porus biliarius* in the *Veſica fellea*.

In the *Tunica Sclerotica*, and *Cornea*, they are of a duſky Colour, but not before they arrive thereat. They admit of a Probe of a pretty Bigneſs, and are of a ſtronger Make than Lympheducts.

He has taken great Pains to trace them to their Origin, but has not yet been able to follow them farther than the Optick Nerve: So that he knows not whether their Riſe may be from ſome Gland not yet diſcovered, or whether the *Glandula pituitaria* may not ſend forth ſome Shoots that conſtitute theſe Ducts.

The Action of the Eyes is *Viſion*; (See that Word:) Which is very well defined by *Diermerbroek*, *viz.* That it is a Senſe whereby from the various Motion of viſible Rays collected in the Cryſtalline and Vitreous Humours, and darting upon the *Tunica Retina*, the Colours of viſible Objects are perceived with their Site, Diſtance, Greatneſs, Figure, and Number; the Medium of which Perception is the Light.

EYE. Dr. *Hook*, in his *Poſthumous Works*, *p.* 12. ſaith, That the diſcerning Power of the Eye, is not capable of making Diſtinction of Parts, when they are ſmaller than the ſmall Pores of Wood; which he found by this Experiment: By a convenient *Lens*, he brought the Object ſo near the Eye, that the croſſing of the Rays in the Eye was about the middle Space between the viſible ſide of the Object and the bottom of his Eye; from whence it followed, that the Picture of the viſible Part of the Object was as big as the Thing repreſented; and the Eye being then at moſt but capable of ſeeing or diſtinguiſhing thoſe Pores; it follows, that if the Cauſe of that Diſtinction be from the Ends of the Filaments of the Optick Nerve, as *Deſcartes* ingeniouſly ſuppoſes, the Filaments can't be ſmaller than the microſcopical Pores of Wood; and that the Eye is uncapable of diſtinguiſhing the Parts of any Object that are ſmaller than thoſe: So that any Object being ſo far remov'd from the Eye, as that its Picture on the *Retina* ſhall be leſs than a microſcopical Pore, will become inviſible; at leaſt if it be but of a dull Radiation; for if it be of a bright one, (as the Stars are) the whole Filament is moved, by having one Part of it powerfully acted on; and ſo we have a Senſation of the Object the ſame as if it were much bigger. And this ſeems to be the Reaſon, why the Stars appear to our naked Eye many thouſand times bigger than they really are, and even as big as thro' a long Teleſcope. And *p.* 13, he ſaith, that if by the Help of Glaſſes, the Eye can be made capable of collecting a much greater Quantity of Rays from a Point, and make them meet in the *Retina*, 'tis not improbable, but that a much greater Number of Bodies may be diſcovered to be *Radiant*, which are now not ſuppoſed to be ſuch.

Eye. The Orbit in which the Eye is placed, is compoſed from ſome of the Bones of the Skull, and upper Jaw together; the upper part of it is made of the *Os Frontis*; the *Os Unguis*, and *Os Planum*, make the inner and lower part of the great Angle; and the *Os Sphænoides*, the inner and lower of the little Angle; the *Os Maxillare* makes the inner and lower part of the Circumference; and the *Os Mali* the outer and lower part: The Organs of Sight are divided into two Parts; the *internal Part*, which is the Globe or Body of the Eye; and the *external Part*, which are thoſe about the Globe, ſubſervient to it. The firſt of the laſt are the Eye-brows, which are nothing but ſome Hairs bunching out above the Eye, by ſome Fat which is under the Skin in that Place; they break the Rays of Light, that they may not be directly darted into the Eyes, which would greatly offend the Sight, as they do when we look directly againſt the Sun. The next are the Eye-lids, two to each Eye; the upper Lid moves very quickly, the under very undiſcernably: The upper Eye-lid is lifted up by the *Muſculus Rectus*, which riſes from the bottom of the Orbit of the Eye, where the Optick Nerve pierces the *Cranium*; and paſſing above the *Superbus*, is inſerted by a large Tendon to the border of the Eye-lid; both Lids are brought together to ſhut upon the Eye by another Muſcle, called *Orbicularis*; it riſes from the great Angle of the Eye, and its Fibres are ſpread two Fingers breadth, covering the under Lid; it reaches to the little *Canthus*, from which continuing its circular Fibres which cover the upper Lid, it is inſerted into the ſame Place from which it aroſe. Some divide this Muſcle into two, the *Superiour*, and the *Inferiour*; which they make to riſe from the great *Canthus*, and to be inſerted into the little *Canthus*. The Eye-lids are covered within by a ſmooth Membrane, called *Conjunctiva*, becauſe it is continued upon the fore-part of the Globe, conſtituting that which we call the White of the Eye; it joins the Globe to the Edges of the Orbit: The Edges of the Eye-lids have two ſmall and ſoft Cartilages, like the Segments of a Circle, called *Cilia*: they keep the Eye-lids extended, that every part may be equally raiſed; upon them there is a Rank of ſmall Glands, whoſe excretory Channels open upon the Edges of the Lids; they yield a Wax which faſteneth the Eye-lids together whilſt we ſleep: They are covered with the Skin externally, and with the *Conjunctiva* internally. Upon the Edges of the Lids there are alſo ſome Hairs in Form of a Palliſado, to preſerve the Eyes, as the Eye-brows do; and to hinder any Filth or Flies from falling into the Eyes.

On the back-ſide of the *Conjunctiva*, upon the upper part of the Globe, is the *Glandula Lachrymalis*, pretty large, divided into ſeveral Lobes, each of which ſends out an excretory Channel, which opens in the fore-ſide of this Membrane, where it covers the upper Lid. This Gland ſeparates the Matter of the Tears, which by the continual Motion of this Lid, moiſten the *Cornea*, which otherwiſe would dry and wrinkle by the continual Action of the external Air; the Edges of the Eye-lids being of an equal Convexity with the Ball of the Eye, which they touch; as the Tears fall from off the *Cornea*, they are ſtopt by the Edge of the under Lid, along which they run, till they fall into two ſmall Holes in the great *Canthus* of the Eye, one in each Eye-lid; thoſe Holes are called *Puncta Lachrymalia*; they lead to a ſmall membranous Bag, which is ſituated in this Corner, upon the *Os Lachrymale*; from the bottom of which there goes a ſmall Pipe, which pierces this Bone into the Noſe, and opens under the upper *Lamina* of the *Os Spongioſum*; it moiſtens the inner Membrane of the Noſtrils, by the Humour of the Lachrymal Gland, which runs from off the Globe into them; ſometimes the Acrimony of this Humour cauſeth Sneezing, which we hinder, by preſſing the Angle of the Eye, and ſo ſtop its running: Between theſe two *Puncta* there is a Caruncle which ſerves to keep them open when the Eyes are ſhut, which was thought to be the *Glandula Lachrymalis.*

The Globe of the Eye is moved by four ſtrait Muſcles, and two oblique; and betwixt them there is a great deal of Fat, which facilitates the Motion of the Globe: The firſt of the four ſtrait Muſcles is called *Attollens*, or *Superbus*; it lies upon the upper part of the Globe, and pulls up the Eye when we look up; the ſecond is called *Deprimens*, or *Humilis*, becauſe it pulleth down the Eye; the third is called *Adductor*, it draweth the Eye towards the Noſe; the fourth *Abductor*, it draweth the Eye towards the little *Canthus*: They riſe all four from the Circumference of the Hole in the Orbit, through which the Optick Nerves paſs; and they terminate about the *Cornea* by four thin and broad Tendons; when they all act together, they draw the Eye towards the bottom of the Orbit; when the *Superbus* and the *Adductor* and *Abductor* act together, or the *Humilis*, and the other two act together, they perform the oblique Motions, which have been attributed to the oblique Muſcles. The firſt of the oblique Muſcles, which is the fifth of the Eye, is the *Obliquus minor*; it riſes from the lower ſide of the Orbit, near its external Circumference, where the firſt and ſecond Bones of the upper Jaw join together; and aſcending oblique by the outer Corner of the Eye, 'tis inſerted into the upper and external ſide of the Globe, behind the Tendon of the *Abductor*. The ſecond of the oblique Muſcles, and the ſixth of the Eye, is the *Obliquus major*; it riſes from the bottom of the Orbit, and marching obliquely towards the great *Canthus*, in the upper part of which, near the Brink, there is a cartilaginous Ring, thro' which it paſſes its round Tendon; from whence reverting backwards, it is inſerted into the upper part of the Globe, behind the Tendon of the *Attollens*. The Uſe of the firſt of theſe Muſcles, is to draw the Globe of the Eye forwards, and to turn its Pupil upwards: And of the ſecond, to draw it forwards, and to turn its Pupil downwards; for the better receiving of the Rays of Light, which could not be perform'd by any of the other four Muſcles: And both of them are an Axis for ſuſpending the Globe; by which, in its almoſt continual Motion, 'tis moved the more eaſily.

Now the Globe of the Eye is of a ſpherical Figure; in it are contain'd the principal Inſtruments of Viſion; it is compoſed of Coats and Humours; the firſt is the *Conjunctiva*; it makes the White of the Eye, as has been already deſcribed: It is full of ſmall Veins and Arteries, which appear big in an *Ophthalmia*, or Inflammation of the Eye. The ſecond is called *Sclerotica*; 'tis thick, hard, and ſmooth; opake behind, but tranſparent before; where it makes the third Coat, called *Cornea*; becauſe it is tranſparent like the Horn of a Lanthorn: In the fore-part of the Eye, which is ſurrounded by the White of the Eye, it has a greater Convexity than the reſt of the Globe of the Eye; and is compoſed of ſeveral parallel *Laminæ*, which are nouriſhed by many Blood Veſſels; ſo fine, as not to hinder even the ſmalleſt Rays of Light from entring the Eye: And it has a moſt exquiſite Senſe; that upon the leaſt Pain the Tears might be ſqueezed out of the Lachrymal Gland, to waſh off any Filth, which, by ſticking to the *Cornea*, might render it opake. The fourth is the *Choroides*; it lies under the *Sclerotica*, and is much thinner than it; it hath a great Number of Blood Veſſels which come from the ſecond, and which are ſpread upon it; as alſo the ſeveral Glands, which ſeparate from the Blood Veſſels a black Liquor, and tinctures all this Membrane internally, which is otherwiſe of a whitiſh Colour: This Coat is open, or has a Hole before, for the Paſſage of the Rays of Light, called *Pupilla*: The part of this Coat which makes the Circumference of this Hole, and which lies upon the Side of the Chryſtalline Humour, is the fifth Coat called the *Uvea*; made of circular and ſtrait Fibres; it contracts and dilates, according to the different Impreſſions of Light, and of Objects. The *Iris* is the outſide of the *Uvea*, where the different Colours appear: On the inſide of the *Uvea*, from its Circumference, which joins the *Choroides*, riſes the *Ligamentum ciliare*: it is made of ſhort Fibres, which run upon the fore-part of the glaſſy Humour, to the Edges of the Chryſtalline, like Lines drawn from the Circumference to the Center: By the Contraction of theſe Fibres, the fore-part of the Eye is made more prominent, and the *Retina* preſſed further back from the Chryſtalline Humour; as the Axis of Viſion is lengthened when Objects are placed too near the Eye. The ſixth is the *Retina*, ſo called, becauſe it reſembles a Net, which covereth the bottom of the cavity of the Eye; it is a fine expanſion of the medullary Fibres of the Optic Nerves upon the ſurface of the glaſſy Humour, as far as the *Ligamentum Ciliare*: It is on this Coat the impreſſions of Objects are made.

The Humours of the Eye are three; the firſt is called the *Aqueous*, it lies in the fore-part of the Globe, immediately under the *Cornea*; this Humour is thin and liquid, of a ſpirituous Nature, for it will not freeze in the greateſt Froſt; this evinces the neceſſity of a continual ſupply of this Humour, which is manifeſt it hath, becauſe if the *Cornea* be prick'd and this Humour ſqueez'd out, it will be reſtored again in ten or twelve Hours: The ſecond Humour is the *Chryſtalline*, it lies immediately next to the *Aqueous*, behind the *Uvea*, oppoſite to the *Pupilla*, nearer to the fore-part than the back-part of the Globe; it is the leaſt of the Humours, but much more ſolid than any of them; its Figure, which is convex on both ſides, reſembles two unequal Segments of Spheres, of which the moſt convex is on its back ſide, which makes a ſmall cavity in the glaſſy Humour in which it lies; it is covered with a ſmall Coat called *Aranea*: The third is the *Glaſſy Humour*, it hath a great reſemblance to the white of an Egg, it filleth all the hind-part of the cavity of the Globe; it is in greater abundance than the other two; it is thicker than the *Aqueous*, but thinner than the *Chryſtalline Humour*; it is contain'd in a very fine Coat of the ſame Name; and it gives the ſpherical Figure to the Eye: Upon its back-part the *Retina* is ſpread, which it holdeth from the *Chryſtalline Humour*, at a diſtance, requiſite to recieve the Impreſſion of Objects diſtinctly.

The Optick Nerves pierce the Globe of the Eye a little on the inſide of the Optick Axes: Their external Coat, which is a Production of the *Dura Mater*, is continued to the *Sclerotis*, as their internal, from the *Pia Mater*, is to the *Choroides*: And their medullary Fibres paſſing through all, are expanded into the *Retina*; upon which the Images of Objects are painted. The Center of this Expanſion is inſenſible; and all Rays which fall upon it are loſt; and conſequently that Point of the Object from which theſe Rays come, is inviſible to the Eye; the reaſon of which proceeds, probably, from the Blood-Veſſels, which enter with the Optic Nerves and cover this part of the *Retina*: But whatſoever its Cauſe is, there is a manifeſt advantage in the Optic Nerves being inſerted on the inſide of the Optic Axes; for if they had pierced the Eye in the Axes, then the middle Point of every Object had been inviſible; and where all things conduce to make us ſee beſt, there we had not ſeen at all, we muſt likewiſe have loſt ſome part of an Object, if the Optic Nerves had been placed on the outſide of the Optic Axes; becauſe an Object may be ſo placed as that all the Rays which come from one Point, may fall upon the outſide of both Eyes; but it is impoſſible they ſhould fall upon the inſide of both Eyes; and therefore that Point which is loſt in one Eye, is viſible by the other.

The Veſſels of the Eyes are Branches of the external *Carotides* and *Jugulars*, which are diſtributed upon the external Parts of the Eyes, and a Vein which opens into the ſuperior *Sinus* of the *Dura Mater*, in the Baſis of the Skull; and an Artery from the internal *Carotide*: They accompany the Optick Nerves, and are diſtributed on the Muſcles and Globe of the Eye: There are alſo ſome Lymphaticks which accompany the Blood Veſſels: The Optick Nerves are pretty big and round: The third Pair of the Brain, called *Pathetici*; the firſt Branch of the fifth Pair, called *Ophthalmicus*; and the ſixth Pair, are all beſtowed on the Muſcles of the Eye.

All the Rays which come from one Point of an Object, are by the *Cornea* and Humours of the Eye, united in a Point of the *Retina*, which is in a ſtrait Line, drawn from the ſame Point of the Object, thro' the Center of the Eye; and conſequently all the Rays, which come from all the Points of an Object, are united on the *Retina*, in the ſame Order and Proportion as the Points of the Object are from whence thoſe Rays come: Therefore the Interpoſition which theſe Rays make upon the *Retina*, muſt be the Image of the Object; and thus Viſion in general is performed: But to know what the ſeveral parts of the Globe contribute hereunto, it is needful to obſerve, that the *Cornea* is more convex than any other Part of it; by which means, all the Rays are gathered to paſs thro' the *Pupilla*; and none of them are loſt upon the *Uvea*; the *Aqueous* Humour being thinneſt, and moſt liquid, eaſily changes its Figure, when either the *Ligamentum Ciliare* contracts, or both the oblique Muſcles ſqueeze, the middle of the Bulb of the Eye, to render it oblong, when Objects are too near us: The ſtrait Fibres of the *Uvea* dilate the *Pupilla*, when there are but few Rays of Light; and the circular Fibres contract it, when there are too many: When the *Pupilla* is contracted, we ſee moſt diſtinctly; when it is dilated, we ſee moſt clearly; the *glaſſy* Humour keeps the *Chryſtalline* at ſuch a diſtance from the *Retina*, as is neceſſary for uniting the Rays which come from one Point of the Object, exactly in one Point of the *Retina*; the Impreſſion of the Object is made upon the *Retina*: The *Choroides* is tinctured black, that the Rays of Light which paſs thro' the *Retina*, may not be reflected back again, to confuſe the Image of the Object, being diſtinct Viſion conſiſts in the Union of all the Rays which come from one Point of an Object, exactly in one Point of the *Retina*; and that the Rays which come from Objects at different Diſtances, are united at different Diſtances, behind the *Chryſtalline Humour*: They cannot both be exactly united upon the *Retina*, therefore the Eye cannot ſee equally diſtinctly at the ſame time Objects at different Diſtances; it is for this Reaſon, that the Globe of the Eye moves ſo quickly, and almoſt continually; and that the Muſcles of the Eyes have ſuch a great Quantity of Nerves to perform their Motions, when the Globe of the Eye is flat, as happens ſometimes in old Age, that the Rays paſs the *Retina* before they unite; in ſuch a Caſe there is no diſtinct Viſion; and ſuch as have this Defect, are called *Presbytæ*: And if, on the contrary, the Globe of the Eye be ſo convex, as to unite the Rays before they come to the *Retina*, neither is there then any diſtinct Viſion; and ſuch as have this Defect, are called *Myopes*.

EYE, in a Ship; the Hole wherein the Ring of the Anchor is put into the Shank, is called the *Eye of the Anchor*; and the Compaſs, or Ring, which is left of the *Strap* to which any *Block is ſeized*, is called alſo the *Eye of the Strap*.

EYE, [in *Architecture*,] is the middle of the *Voluta* of the *Ionick* Chapiter, which is cut in the Form of a little Roſe.

EYE *of a Dome*, is an Aperture at the Top of a Dome, as that of St. *Paul's*.

EYE *of a Volute* [in *Architecture*,] is the Center of the Volute, or that Point wherein the *Helix* or *Spiral* of which it is formed commences; or it is the little Circle in the middle of the Volutes, wherein the 13 Centers for the deſcribing of the 13 Circumvolutions are found, for deſcribing the Circumvolutions of it.

Bullock's EYE, [in *Architecture*,] a little Sky-light in the Covering or Roof, intended to illumine a Granary or the like; call'd by the *French*, *Oevil de Bœuf*.

EYE-LIDS: See *Palpebræ*.

F. By Statue 5 and 6 *E. 6. cap.* 4. 'tis enacted, That whoever ſhall maliciouſly ſtrike any Perſon with a Weapon in the Church or Church-yard, or draw it there, with an Intent to ſtrike, ſhall have one of his Ears cut off; or if he have no Ears, ſhall be burnt on the Cheek with an *F*; that he may be known for a common Fighter or Fray-maker.

FA [in *Muſick*,] is the fourth Note in riſing, in this Order of the Gammut, *Ut*, *Re*, *Mi*, *Fa*.

FABRICK *Lands*, are Lands given to the Rebuilding, Repair, or Maintenance of Cathedrals, and other Churches; and mentioned in the Act of Oblivion, 12 *Car.* 2. *c.* 8. Formerly every one almoſt gave by his Will ſomething, more or leſs, to the Fabrick of the Cathedral, or his Pariſh Church; and theſe were called *Fabrick Lands*; and by the *Saxons*, *Timber Lands*.

FACE, [in *Architecture*,] is a flat Member, which hath a great Breadth, and ſmall Projecture; as in Architraves, *&c.* It is alſo taken for the Front, or exterior Part of a great Building, which immediately preſents it ſelf to view.

FACE *of a Baſtion*, or *of the Bulwark*, is the moſt advanced Part of a Baſtion toward the Field, or the Diſtance comprehended between the Angle of the Shoulder, and the flanked Angle.

FACE *of a Place*, is the Curtain, together with the two Flanks raiſed above it, and the two Faces of the Baſtion that look towards one another, and flank'd the Angle of the Tenacle.

FACE *Prolong'd*, [in *Fortification*,] is that Part of the Line of Defence Razant, which lies between the Angle of the Shoulder and the Curtain; or 'tis the Line of Defence Razant diminiſhed by the Length of a Face.

FACE *of a Stone* [with *Architects*,] is that Superficies or Plane of the Stone that is to lie in the Front of the Work, which is very eaſy to be known, when the Stones are ſcrap'd; for the Face is always oppoſite to the Back, and the Back goes rough as it comes from the Quarry. But in rough Stones, Workmen generally chooſe to make one of thoſe Sides the *Face*, which lay perpendicular to the Horizon, when it was in the Quarry; and conſequently, the breaking (and not the cleaving) way of the Stone.

FACEING [in *Architecture*,] a Method of Building, when all betwixt the Timber is a Brick's length thick, (or a 9 Inch Wall) and againſt the Timber but half a Brick thick, or a 4 ½ Inch Wall. But this is not approv'd of, becauſe in thin faceing Timber Building, the Mortar burns the Timber ſo much.

FACET, } a little Face or Side of a Body,
FACETTE, } cut into a great Number of Angles.

FACIA's [in *Architecture*,] as the Workmen call it, (for it ſhould be ſpelt *Faſciæ*,) are nothing but broad Liſts or Fillets, and are commonly made in Architraves, and in the Corners of Pedeſtals. In Brick Buildings, they call the Juttings-out of the Bricks over the Windows in all Stories but the higheſt, by this Name; theſe are ſometimes plain, and ſometimes moulded; and this Moulding is only a *Cima Reverſa*, or an *O* ... *G* ... at the Bottom; and above this are two plain Courſes of Bricks, then an Aſtragal, and laſt of all, a *Boultine*; which the Workmen call a *Boultreau* and a *Boltell*.

FACIES *Hypocratica*, is when the Noſtrils are ſharp, the Eyes hollow, the Temples low, the Laps of the Ears contracted, and the Lobes inverted; the Skin above the Forehead hard and dry, the Complexion pale, livid, of a leaden Colour, or black. *Blanchard.* L.

FACK, in a Ship, is any one round of a Cable when it is quoiled up out of the Way.

FACTITIOUS, ſignifies made by Art, and is uſually taken in oppoſition to the Word Natural: Thus *Soap* is a factitious Body, or Concrete, made by Art; but *Fullers-Earth* is a natural Concrete, form'd in the Bowels of the Earth by the Author of Nature.

FACTORS: [In *Multiplication*] the Multiplicand and Multiplicator are often called *Factors*, becauſe they do *Facere Productum*, make or conſtitute the Product.

FACTUM [in *Arithmetick*,] is the Product of two Quantities multiply'd by each other.

FACULÆ, are certain bright or ſhining Parts, which the Modern Aſtronomers have ſometimes obſerved upon, or about the Surface of the Sun; but they are but very ſeldom ſeen. *L.*

FACULTY, [in *Law*,] is uſed for a Privilege or ſpecial Power granted unto a Man by Favour, Indulgence, and Diſpenſation, to do that which by the Common Law he cannot do.

FACULTY, is a Power or Ability to perform any Action. The Ancients uſually reckon three ſorts of Faculties, *Natural*, *Vital*, and *Animal*; and according to their Doctrine, the

Natural Faculty, is that by which the Body is nouriſhed and augmented, or another like it generated: So that it may be diſtinguiſh'd into the three Faculties that perform their Functions of *Nutrition*, *Growth*, or *Generation*: And the firſt of theſe was alſo ſubdivided into the *Attractive*, *Retentrix*, *Concoctrix*, and *Expultrix Faculty*.

Vital Faculty, is that which preſerves Life in the Body, and performs the Functions of *Pulſe* and *Reſpiration*.

Animal Faculty, is that by which the Soul performs the Functions of *Imagination*, *Reaſoning*, *Memory*, *Senſe*, and *Motion*.

But theſe, like moſt other Diſtinctions of the ancient Philoſophers, are both uſeleſs and ill grounded.

FACULTY, [in the *Schools*,] a Term apply'd to the divers Parts or Members of an Univerſity, divided according to the Arts or Sciences taught, or profeſs'd therein. Thus in moſt Univerſities there are four *Faculties*; as 1. Of *Arts*, which includes *Humanities* and *Philoſophy*. 2. That of *Theology*. 3. *Phyſick*. 4. *Juriſprudence*. And in our Univerſities the Degrees of the ſeveral *Faculties* are, *Batchelor*, *Maſter*, and *Doctor*.

FÆCES: See *Excrements*. 'Tis alſo taken for the groſs Subſtance that ſettles after Fermentation, or remains after Diſtillation. *L.*

FAGGOT. In Times of Popery here was a Badge worn on the Sleeve of the upper Garment of ſuch Perſons as had recanted and abjured what the Powers that then were, did call Hereſy; which was put on after the poor Wretches had carried a *Faggot* by way of Penance, to ſome appointed

Place of Solemnity. And ſometimes they interpreted the leaving off this Badge of the *Faggot* to be a Sign of Apoſtacy.

FAGONA, [in *Anatomy*,] a conglomerated Gland, the ſame that is call'd *Thymus*.

FAILLIS [in *Heraldry*,] a Term that *French* Heralds uſe, to ſignify ſome Failure or Flaw in an Ordinary, as if it were broke, and a Splinter taken out of it.

FAINT, or *Feynt Action*, is as much as *Feigned Action*, *viz.* ſuch an Action, as though the Words of the Writ be true, yet for certain Cauſes he hath no Title to recover thereby; whereas in a falſe Action the Words of the Writ are falſe.

FAINT *Viſion*: See *Viſion*.

FAIT [in *Law*,] a Deed, which is a Writing ſealed and delivered, to prove and teſtify the Agreement of the Parties whoſe Deed it is; and conſiſts of three principal Points, *Writing*, *Sealing*, and *Delivery*.

By *Writing* is ſhew'd the Parties Name to the Deed, their Dwelling-places, Degrees, Thing granted, upon what Conſideration, the Eſtate limited, the Time when granted, and whether Simply, or upon Condition, *&c.*

Sealing, is a further Teſtimony of their Conſents, as appears by theſe Words, *In witneſs whereof*, &c. *In cujus rei Teſtimonium*, *&c.* without which the Deed is inſufficient.

Delivery, tho' it be ſet laſt, it is not the leaſt; for after a Deed is Written and Sealed, if it be not Delivered, it is to no purpoſe: And therefore in all Deeds care muſt be taken, that the *Delivery* be well proved.

FAKE, is one Round or Circle of a Cable quoiled up out of the way: The Seamen will ask (as a Cable is veered out) how many *Fakes* there are left, that is, how much is behind unveered out.

FALCATED: The Aſtronomers ſay the Moon, or any Planet appears *falcated*, when the enlightned Part appears in the Form of a Sickle, or Reaping-Hook; which is while ſhe is moving from the Conjunction to the Oppoſition, or from New Moon to Full; but from Full to a New again, the enlighten'd part appears *gibbous*, and the Dark *falcated*.

FALCON: See *Faucon*.

FALCONET: See *Fauconet*.

FALDAGE *Faldagium*, is a Privilege which antiently ſeveral Lords reſerved to themſelves of ſetting up Folds for Sheep in any Fields within their Manors, the better to manure them; and this not only with their own, but their Tenants Sheep, which they called *Secta Faldæ*. This Faldage in ſome Places they call a *Fold Courſe*, or *Free Fold*; and in ſome old Charters 'tis called *Foldſoca*, i. e. *Libertas Faldæ*, or *Faldagii*.

FALDFEY, or *Faldfee*, was a Compoſition paid ſome cuſtomary Tenants antiently, that they might have Liberty to fold their Sheep upon their own Ground.

FALL: The Seamen call that part of the Rope of a Tackle which is haled upon, the *Fall*. Alſo a Ship is ſaid to

FALL *off*, when being under Sail, ſhe keeps not ſo near the Wind as ſhe ſhould do. They ſay alſo that a Ship hath

FALLS, when ſhe is not *Fluſh*, but hath Riſings of ſome Parts of her Decks more than others.

FALLING-*Sickneſs*: See *Epilepſy*.

FALLOPIAN *Tubes*, or the *Tubæ Fallopianæ*, in *Anatomy*, are two ſlender Veſſels ſituated on each ſide the *Uterus*, whoſe uſe is to afford a Paſſage to a more ſubtil part of the *Genitura Maſculina* towards the *Ovaria*, to impregnate the Eggs that afterwards are to drop into them from thence; and when they are, as it were, ripen'd, to convey them along their inner Cavity to the *Uterus*.

Theſe *Tubæ* are about four or five Fingers breadth long, and their Subſtance is compoſed of two Membranes which come from the external and internal ones of the Womb; they have the ſame Arteries, Veins, Nerves, and Lymphaticks, as the *Ovaria* have. They take their Name from their firſt Diſcoverer *Fallopius*.

FALSE *Attack*: See *Attack*.

FALSE *Braye*, [in *Fortification*,] is a ſmall Mount of Earth four Fathom wide, erected on the Level round the Foot of the Rampart, on that ſide towards the Field, and ſeparated by its Parapet from the *Berme*, and the Side of the Moat. 'Tis made uſe of to Fire upon the Enemy, when he is already ſo far advanced, that you cannot force him back from off the Parapet of the Body of the Place: And alſo to receive the Ruins which the Cannons make in the Body of the Place.

FALSE *Arms*, [in *Heraldry*,] are ſuch in which the fundamental Rules of the Art are not obſerv'd; as if Colour be put upon Colour, and Metal upon Metal, *&c.*

FALSE *Flower* [in *Botany*,] one which does not ſeem to produce any Fruit, as thoſe of the *Harle*, *Mulberry-Tree*, &c. Or a Flower that does not ariſe from any Embryo, or that does not knit; as thoſe of the *Melon*, *Cucumber*, &c.

FALSE *Claim*, [in *Law*,] is where a Man claims more than his due.

FALSE *Impriſonment*, is a Treſpaſs committed againſt a Man, by *impriſoning* him without lawful Cauſe.

FALSE *Poſition*: See *Poſition*.

Crimen FALSI, [in the *Civil Law*,] is a fraudulent Subornation or Concealment, with a deſign to darken or hide the Truth, and make Things appear otherwiſe than they are. *L.*

FALSO *Judicio*, is a Writ that lieth for *falſe Judgment*, given in the County, Hundred, Court-Baron, or other Courts, being no Courts of Record, be the Plea Real or Perſonal. *L.*

FALSO *retorno brevium*, is a Writ which lies againſt the Sheriff, for falſe returning of Writs. *L.*

FALX, [in *Anatomy*,] is one of the three Proceſſes made by the doubling of the *Dura Mater*; it riſes by a narrow Beginning from the *Criſta Galli*, to which it is faſtned; and as it approaches the hinder-part of the Head, it grows broader and broader, till it terminates where the *Longitudinal Sinus* ends. It divides the *Cerebrum* into two Hemiſpheres, near as deep as the *Corpus Calloſum*. 'Tis called *Falx* from its reſembling a Sickle. *L.*

FAMES *Canina*: See *Cynodes Orexis*.

FAMILY *of Curves*, is a Congeries of ſeveral Curves of different kinds or orders; all which are defin'd by the ſame indeterminate Equation; but in a different manner, according to their different kinds or orders.

Suppoſe *e g* the indeterminate Equation; $a^m - 1\,x = y^m$; If $m = 2\ a\,x = y^2$; If $m = 3\ a^2\,x = y^3$; If $m = 4\ a^3\,x = y^4$, *&c. in infinitum*: All which Curves are ſaid to be of the ſame Family.

FANCY: See *Phantaſy*, or *Imagination*.

FANTASTICAL *Colours*, the ſame with thoſe called *Emphatical*; which ſee.

FAPESMO [in *Logick*,] one of the Moods of Syllogiſms that has its firſt Propoſition an univerſal Affirmative, its ſecond an univerſal Negative, and its third a peculiar Negative.

FARCIMINALIS *Tunica*, the ſame with the *Allantoides*. L.

FARDEL *of Land*, according to ſome Writers, is the fourth Part of a Yard Land; but *Noy*, in his *Complete Lawyer*, *p.* 57, ſaith, two Fardels of Land make a Nook, and four Nooks a Yard Land.

FARDING, or *Farthing*, *of Gold*, ſeems to have been a Coin uſed in antient Times, containing in Value the fourth Part of a Noble, *viz.* Twenty-pence in Silver: In Weight, the ſixth Part of an Ounce of Gold, that is, of five Shillings in Silver. This Word is uſed 9 *H.* 5. *c.* 7. and there appears to have been a Coin as well as the Noble and Half Noble.

FARDING-*Deal*, or *Farundel of Land*, was the fourth Part of an Acre.

FARINA *Fœcundans*, [in *Botany*,] a kind of fine mealy Duſt, prepared in the male Flowers of Plants, which being afterwards ſhed on the female Plants, does the Office of a *Sperm* or *Semen*, by impregnating them.

FARTHELL. *Farthelling* is the ſame with what the Seamen now call *Furl* or *Furling*; which is taking up their Sails and binding them cloſe to the Yards.

FASCIA *Lata*: See *Membranoſus Muſculus.*

FASCIA, a Term in *Architecture*, as the *Faſcia's* of the Architrave; which are the three Bands of which it is compoſed. *L.*

Vitruvius admits no *Faſcia's* in the *Tuſcan* or *Dorick* Orders; but is not imitated by any in that particular Circumſtance.

FASCIÆ: In the Planet *Mars*, are certain rows of Spots parallel to the Equator of that Planet, which look like Swathes or Fillets wound round about his Body. *L.*

FASCIALIS, a Muſcle ſo called: See *Sartorius.*

FASCIATION, is a binding of Swathes about a Limb that is to be cured.

FASCICULUS: See *Manipulus.*

FASCINES, or *Faggots*, [in *Fortification*,] are ſmall Branches of Trees, or Bavins bound up in Bundles; which being mix'd with Earth, ſerve to fill up Ditches, to make the Parapets of Trenches, *&c.* Some of them are dipt in melted Pitch or Tar, and being ſet on fire, ſerve to burn the Enemies Lodgments or other Works.

FASHION-*Pieces*, are thoſe two Timbers which deſcribe the Breadth of the Ship at the Stern; and are the outermoſt Timbers of the Stern, on each ſide, except aloft, where the Counters are.

FAST-*Country*. A Term uſed by the Tin-Miners, and ſignifies the ſame with *Shelf*; which ſee.

FASTIDIUM *Cibi*, the ſame with *Anorexia.*

FASTIGIUM, the ſame with *Fronton*; which ſee.

FASTING *Men*, *Homines habentes*. An old Term which ſome will have to ſignify Men of Repute and Subſtance: But 'tis more probable, that by it was meant rather Pledges, Sureties, or Bondſmen; which, according to the *Saxon* Cuſtom, were faſt bound to anſwer for one anothers peaceable Behaviour.

FAT of Animals, the learned Dr. *Grew* takes to be a curdling or Coagulation of the Oily Parts of the Blood, either by ſome of its own ſaline Parts, or by the nitrous Parts of the Air mingled therewith: And hence it is, that ſome Animals, as Coneys, and Field-Hares, grow fat in froſty Weather the Oily Parts of the Blood being then ordinarily coagulated with a greater Abundance of nitrous Parts received from the Air into their Bodies; and for the ſame Reaſon it is, that the *Fat* of Land Animals is hard; whereas that of Fiſhes is ſoft, and runs all to Oil, becauſe the Water in which they live, hath but few nitrous Parts in it, in compariſon of Air.

And that which induced him to make theſe Concluſions, was this Experiment:

He took Oil-Olive, and poured upon it highly rectified Spirit of Nitre, and then digeſted them together for ſome Days: By degrees the Oil became of the Colour and Conſiſtence of Marrow, and at laſt *congealed*, or hardned into a white Fat or Butter, which would diſſolve only by the Fire like the *Fat* of Animals: And he obſerved, that this Oil hardned into *Fat* moſt, upon the Exhalation of ſome of the ſulphureous Parts of the Spirit of Nitre; which Exhalation was effected by unſtopping the Glaſs, after ſome time of Digeſtion, and ſuffering the Oil to diſſolve and thicken divers times by ſucceſſive Heat and Cold. And from hence he infers, That the *true congealing Principle, is a Spirit of Nitre ſeparated from its Sulphur:* And he ſays, If we could get this, we might congeal Water in the midſt of Summer. *Power of Mixture*, *Lect.* 1. *p.* 233.

FAT, in the *Sea Phraſe*, is the ſame with broad. Thus, if the *Truſſing in*, or *Tuck* of a Ship's Quarter under Water be deep, they ſay ſhe hath a *Fat Quarter.*

FATHOM, a Meaſure containing two Yards, or ſix Feet, taken from the Extent of both Arms, when ſtretch'd into a ſtrait Line.

FACUS and *Frumen*, the ſame that *Pharynx.*

FAUCON, a ſort of Cannon, whoſe Diameter at the Bore is 5$\frac{1}{4}$ Inches, Weight 750 Pound, Length 7 Foot, Load 2$\frac{1}{4}$ Pound, Shot 2$\frac{1}{2}$ Diameter, and 2$\frac{1}{2}$ Weight.

FAUCONET, a ſort of Ordnance, whoſe Diameter at the Bore is 4$\frac{1}{2}$ Inches, Weight 400 Pounds, Length 6 Foot, Load 1$\frac{1}{4}$ Pound, Shot ſomething more than two Inches Diameter, and 1$\frac{1}{4}$ Pound Weight.

FAUSBRAYE: See *Falſe Braye.*

FAVUS: See in *Achor.*

FAYLING *of Record*, is when an Action is brought againſt one who pleads any Matter or *Record*, and avers to prove it by *Record*; and the Plaintiff ſaith, *Nul tiel Record*, whereupon the Defendant hath a Day given him to bring it in, at which Day he fails, or brings in ſuch a one as is no bar to this Action; this is ſaid to be *Failer of Record.*

FAYNT-*Pleader*, [in *Law*,] ſignifies a falſe, covinous, or colluſory Manner of Pleading, to the Deceit of a third Party.

FEALTY, [in *Law*,] ſignifies an Oath taken at the Admittance of every Tenant, to be true to the Lord of whom he holdeth his Land.

FEATHER *Edg'd*, [in *Carpentry*,] Boards or Planks that are thicker on one Edge than on the other, are call'd *Feather edg'd* Boards, *&c.*

FEVER, is a Fermentation, or inordinate Motion of the Blood, and a too great Heat of it, attended with Burning, Thirſt, and other Symptoms, whereby the natural Oeconomy or Government of the Body is variouſly diſturb'd.

Fevers, in general, may be divided into two ſorts, *viz.* *Continual*, or *Intermittent*. *Continual*

Fever, is that whoſe Fit is continued for many Days, having its Times of Remiſſion, and of more Fierceneſs, but never of Intermiſſion.

Intermittent Fevers, commonly called *Agues*, have certain Times of Intermiſſion, beginning, for the moſt part, with Cold or Shivering, ending in Sweat, and returning exactly at ſet Periods.

As for the ſeveral ſubaltern Spices of *Continual* and *Intermitting Fevers*, you will find them particularly enumerated in the Books of Phyſicians.

FEAZING, at *Sea*, is the ravelling out of the Cable, or any great Rope at the Ends.

FEBRIFUGE [*Febrifugium*, L.] is a Medicine which will cure an intermitting Fever: Thus we ſay the *Cortex Peruvianus*, or *Jeſuits-Bark*, rightly given, is the moſt certain *Febrifuge*.

FECULÆ, are Dregs that ſubſide in the ſqueezing of certain Vegetables; as in *Briony*, &c. *L*

FEE, *Feudum vel Feodum*, [in *Common Law*,] ſignifies, as Sir *Henry Spelman* defines it, a Right which the Vaſſal hath in Land, or ſome immoveable Thing of his Lord's, to uſe the ſame, and take the Profits thereof Hereditarily, rendring unto his Lord ſuch feudal Duties and Services as belong to military Tenure, the meer Propriety of the Soil always remaining to the Lord.

This Word *Fee* is ſometimes uſed with us for the Compaſs or Circuit of a Manor or Lordſhip; alſo for a perſonal Right incorporeal, as to have the keeping of Priſons in *Fee*. And 'tis taken for a Reward or Wages given to one for the Execution of his Office: As alſo, for that Conſideration given a Serjeant at Law, or Counſellor, or a Phyſician, for their Counſel and Advice in their Profeſſion.

FEE-*Abſolute*, or *Fee-Simple*, is that of which we are ſeized in theſe general Words, *To us and our Heirs for ever.*

FEE-*Conditional*, or *Fee-Tail*, is that whereof we are ſeized to us and our Heirs with Limitation; that is, the Heirs of our Bodies, &c. And this *Fee-Tail* is either *General* or *Special.*

General, is where Land is given to a Man, and the Heirs of his Body.

Fee-Tail Special, is that where a Man and his Wife be ſeized of Lands, to them and the Heirs of their Bodies.

FEE-*Farm*, in a legal Senſe, ſignifies Lands held of another in *Fee*, that is, in Perpetuity to himſelf and his Heirs, for ſo much yearly Rent as it is reaſonably worth, more or leſs, ſo it be the fourth Part of the Worth: *Old Tenures.*

FEE-*Simple*: See *Fee-Abſolute.*

FEE-*Tail*: See *Fee-Conditional.*

FIELD, [in *Heraldry*,] is the whole Surface of any Eſcutcheon or Shield, being ſuppoſed to be overſpread with ſome Metal, Furr, or Colour; and containing the Charge, if there be any. In blazoning a Coat, you muſt always begin with the Field: See *Blazon.*

FEELING, is one of the external Senſes call'd *Touching*; and is that whereby we get the Ideas of hard, ſolid, ſoft, rough, hot, cold, dry, wet, or other tangible Qualities; as alſo of Diſtance, Titillation, Itching, Pain, &c. And tho' it is the groſſeſt, yet it is the moſt extenſive of all our Senſes, having more Objects than all the reſt taken together: And ſome even reduce all the other Senſes to this one of *Feeling.*

FEINT [in *Muſick*,] a Semi-tone; the ſame that is called *Dieſis.*

FEINT, [in *Rhetorick*,] a Rhetorical Figure, whereby the Orator touches on ſomething, in making a ſhew of paſſing it over in Silence.

FELAPTON [in *Logick*,] is one of the Moods of Syllogiſms, in which the firſt Propoſition is an univerſal Negative, the ſecond an univerſal Affirmative, and the third a particular Negative.

FELLOWS [in *Fortification*,] are ſix Pieces of Wood, each of which form an Arch of a Circle; and theſe, joined all together by *Duledges*, make an entire Circle; and theſe with twelve Spokes, make the Wheel of a Gun Carriage. Their Thickneſs is uſually the Diameter of the Ball of the Gun they ſerve for, and their Breadth ſomething more.

FELLOWSHIP, or *Partnerſhip*, [in *Arithmetick*,] is a Rule of very great Uſe to balance Accounts amongſt Merchants and Owners of Ships; when any Number of Perſons put together a general Stock, ſo that it be required to give to every one his proportional Share of the Loſs or Gain:

The *Golden Rule* ſeveral ways repeated, will fully anſwer ſuch Queſtions.

For, *As the whole Stock* (or general Antecedent): *Is to the Total thereby gain'd or loſt* (which is the general Conſequent):: *So each Man's particular Share*: *Is to his proper Share of Loſs or Gain.*

Wherefore let the ſeveral Moneys of every Partner be gathered into one Sum, which makes the Firſt Term; the common Gain or Loſs the Second; every Man's particular Share the Third; working the *Golden Rule* ſo many ſeveral times as there are Partners.

There be two Parts of this Rule, *without Time* and *with Time*

Fellowſhip without Time.

Example I.

A, B, *and* C, *freight a Ship with Wine*; viz. A *lays out* 1342 l. B, 1178 l. C, 630 l. *the whole* 212 *Tun of Wine is ſold at* 32 l. *a Tun. What ſhall each Man receive?*

Firſt find out the Price received, by multiplying 212 by 32, which makes 6784: Then add up the ſeveral Stocks, 1342 *l.* 1178 *l.* and 630 *l.* which makes 3150 *l.* and the Work ſtands thus:

$$3150 : 6784 :: \left\{ \begin{array}{l} 1342 : \text{Anſwer } 2890{,}199 + \\ 1178 : \text{Anſwer } 2537{,}001 + \\ 630 : \text{Anſwer } 1356{,}800 \end{array} \right.$$

$$\text{Proof } 3150 \qquad 6784$$

Example II.

A *hath Half a Ship*, B *a Quarter*, C *one Sixteenth, and* D *three Sixteenths*: *The Maſter of the Ship brings an Account, and clears* 120 l. *How much muſt each Perſon have?*

Account the Ship is 16, and the Gain 120 *l.*

$$16 : 120 :: \left\{ \begin{array}{l} 8 : \text{Anſwer } 60 \\ 4 : \text{Anſwer } 30 \\ 1 : \text{Anſwet } 7,5 \\ 3 : \text{Anſwer } 22,5 \end{array} \right.$$

$$16 \qquad 120$$

Fellowſhip with Time.

Example I.

A Ship's Company take a Prize of 300 l. *which is to be divided amongſt them, according to their Pay and Time they have been on Board: The Officers and Midſhip-Men* 5 *Months, and the Sailors* 3 *Months: The Officers one with another,* 40 s. per *Month; the Midſhip-Men* 30 s. per *Month; and the Sailors* 22 s. per *Month: There were* 6 *Officers,* 12 *Midſhip-Men,* 84 *Sailors: What muſt each Party have of the Prize?*

For a general Stock I begin firſt with the Officers, which are 6, and that multiplied by the Rate of 40 *s.* gives 240, which multiplied by 5 Months, make 1200 *s.*

After the ſame faſhion I find the Midſhip-Mens Stock 1800 *s*, and the Sailors 5544 *s*. All added together make 8544 *s*. for the whole Stock; and the Work ſtands thus:

8544:300:: 1200: Anſwer 42,1232
1800: Anſwer 63,2029 | 299,999 = 300
5544: Anſwer 194,6629

Which Decimals reduced, give for

Officers	42	2	2
Midſhip-Men	63	4	¼
Sailors	194	13	5

Example II.

A, B, C, *enter into Partnerſhip, the firſt of* January, *for a whole Year: A the ſame Day diſburſed* 100 l. *whereof he received back again upon the firſt of* April 20 l. B *payeth on the firſt of* March 60 l. *and more the firſt of* Auguſt 100 l. C *payeth the firſt of* July 140 l. *but the firſt of* October *withdraweth* 40 l. *At the Year's End their clear Gain is* 142 l. *How much therefore ought every particular Perſon to have?*

Anſwer:

A 51*l.* *B* 55*l.* *C* 36*l.* which makes the whole Gain 142*l.* without Conſideration of Intereſt. For *A* 100 into 3, is 300*l.* and 80 into 9 = 720, in all 1020 *l.* for *A*: For *B*, 60 into 10, is 600, and 100 into 5, is 500, in all 1100 for *B*: For *C*, 140 into 3, is 420, and 100 in 3, is 300; into all 720 for *C*.

Now 1020 + 1100 + 720 = 2840 for the General Antecedent, and the Gain 142 for the General Conſequent; then the Rule ſtands thus:

2840 : 142 :: 1020 : Anſwer 51
1100 : Anſwer 55
720 : Anſwer 36
142 *l.*

FELO *de ſe*, is he that commits Felony by Murthering of himſelf.

FELONY, [in *Common Law*,] is accounted any Offence that is in Degree next *Petit-Treaſon*; and compriſeth divers Particulars, as Murther, Theft, killing of a Man's Self, Sodomy, Rape, wilful burning of Houſes, and ſuch like.

The Difference between *Felony* and lighter Offences, is this, That the Puniſhment thereof is Death; yet not in all Caſes: For *Petit-Larceny*, which is the ſtealing of any Thing under Value of Twelve-pence, is *Felony*, becauſe the Indictment againſt ſuch a one muſt have theſe Words *Felonice cepit*; and yet this is not puniſhed by Death, though it be loſs of Goods. Any other Exception I know not, but that a Man may call that *Felony*, which is under *Petit-Treaſon*, and puniſhed by Death. And of this may be reckon'd two ſorts one lighter, that for the firſt time may have the benefit of the Clergy, another that may not.

FEME *Covert*, [in *Law*,] a married Woman; who is alſo ſaid to be under *Covert Baron.*

FEMOREUS: See *Crureus.*

FEMUR, and *Femen*, the Thigh, the Part from the Buttocks to the Knee; it is ſo called *à ferendo* from bearing, becauſe it holds up, and ſuſtains an Animal. It conſiſts but of one Bone, but that the greateſt and longeſt in the whole Body, whoſe external and fore-part is gibbous or riſing, but the internal hinder-part flat and bending. Grammarians make *Femen* to be the hinder fleſhy part; and *Femur* the former outward part. *L. Blanchard.*

FEND, (for defend) is the Sea Word for ſaving a Boat from being daſh'd againſt the Rocks, Shore, or Ship's Sides. This they call *fending the Boat*; and accordingly

FENDERS with them ſignify any Pieces of old Cable Ropes or Billets of Wood, which they hang over the Ship's Side to keep other Ships from rubbing againſt her. Boats have the ſame, as alſo little ſhort Staves, called by this Name of *Fenders*, with which they keep the Boat from beating and ſtaving againſt the Ship's Side.

FENDU *en Pal* [in *Heraldry*,] a Term apply'd to a Croſs, to denote it cloven from Top to Bottom, and the Parts ſet at ſome Diſtance one from another. *F.*

FENESTRA *Ovalis*, is a Hole in the Barrel of the Ear, whereon the Baſis of the *Stapes* ſtands: It is the Entry to the *Veſtibulum.* L.

FENESTRA *Rotunda*, is a Hole in the Barrel of the Ear, which leads to the *Cochlea*, and is covered by a fine Membrane, inchaſed in a Rift of this Hole. *L.*

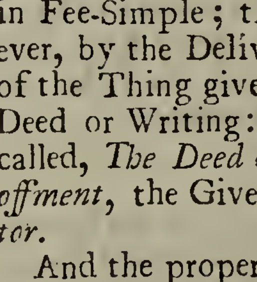
FEOD: See *Fee.*

FEOFFEE, is he that is infeoffed, or to whom the Feoffment is ſo made.

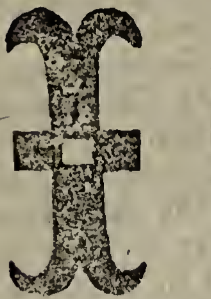
FEOFFMENT, [in *Common Law*,] ſignifies any Gift or Grant of any Honours, Caſtles, Manors, Meſſuages, Lands, or other corporeal and immoveable Things of like Nature, unto another in Fee-Simple; that is, to him and his Heirs for ever, by the Delivery of Seiſin, and the Poſſeſſion of the Thing given, whether the Gift be made by Deed or Writing: And when it is in Writing, 'tis called, *The Deed of* Feoffment; and in every *Feoffment*, the Giver is called the *Feoffor*, or *Feoffator.*

And the proper Difference between a Feoffer and a Donor, is, that the Feoffer gives in Fee-Simple, the Donor in Fee-Tail.

FEOFFOR, is he that infeoffs, or makes a Feoffment to another, of Lands or Tenements in Fee-Simple.



FER *de fourchette* [in *Heraldry*,] as a *Croix fer de fourchette*, ſignifies a Croſs having a forked Iron at each End, like that formerly us'd by Soldiers to reſt their Muſkets on; by which it is diſtinguiſhed from the *Croſs fourchee*, the Ends whereof are turn'd forked; whereas in this the Fork is fix'd on the ſquare End; as in the adjoining Figure.



FER-DEMOULIN, a Bearing in *Heraldry* of this Figure. It repreſents the Iron-Ink, or Ink of a Mill; and is born by the Name of *Beverthàm*, and alſo by the Name *Turner*.

FERMENTATION, is an eaſy, gentle, ſlow Motion of the Inteſtine or inward Particles of a mix'd Body, ariſing uſually from the Operation of ſome active acid Matter which rarifies, exalts, and ſubtilizes the ſoft and ſulphureous Particles; as when *Leaven* or *Yeaſt*, rarifies, lightens, and ferments *Bread*, or *Wort*, &c. And this Motion differs much from that uſually called *Ebullition* or *Efferveſcence*, which is a violent boiling and ſtruggling between an *Acid* and an *Alkali*, when mix'd together.

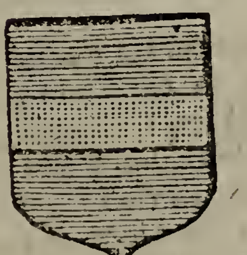
Hence any gentle Motion of the Parts of the Blood, or Juices in the Body, occaſioned by ſomething which helps to clarify, exalt, and ſubtilize them, and to reduce them into a healthful and natural State, is called by this Name of *Fermentation*, as well as in the expreſſed Juices of Fruits, &c. *Lemery* confounds Efferveſcence and Fermentation together, but I think erroneouſly.

FERRUGINOUS, [*Ferrugineus* of *Ferrum*, L. Iron,] that which hath in it ſomething of the Nature of Iron; as thoſe Waters have which are otherwiſe called *Chalybeate*, ſuch as thoſe of *Tunbridge Wells*, &c.

FERULÆ, which the Surgeons call *Splinters*, are little Chips or Planes, which are made of different Matter, according to the Nature and Neceſſities of the Places to which they are applied, as of Barks of Trees, of the Bark of the Herb *Sagapene*, in *Latin*, *Ferula*; whence they have their Name: They are made of Firr, Paper glew'd together, Leather, &c. which are apply'd to Bones that have been looſened or disjointed, after they are ſet again. *L. Blanchard.*

FESCENNINE *Verſes*, a kind of ſatyrical Verſes, full of open, wanton, and obſcene Expreſſions; ſung at Weddings.

FESSE, one of the Honourable Ordinaries in *Heraldry*, repreſenting a broad Girdle, or Belt of Honour, which Knights at Arms were antiently girded withal. It poſſeſſeth the Centre of the Eſcutcheon, and contains in Breadth one third part thereof; thus.



He beareth *Azure*, a *Feſſe Or*, by the Name of *Eliott*.

The *Feſſe* is divided into the *Barr*, and the *Cloſet* of the *Barrulet*; which ſee. *Feſſe Point*, is the very middle Point: See the Word *Eſcutcheon*.

FESSE *Ways*, or *in Feſſe*, ſignifies Things born after the manner of a *Feſſe*, i. e. in a Line or Range acroſs the middle of a Shield; which the *French* call *en feſſe*.

Party per FESSE, ſignifies parted acroſs the middle of the Shield from Side to Side, through the *Feſſe Point*.

FESTING [in *Logick*,] one of the Moods of Syllogiſms, of which the firſt Propoſition is an univerſal Negative, the ſecond a particular Affirmative, and the third a particular Negative.

FESTOON [in *Architecture*,] an Ornament of carved Work in the form of a Wreath or Garland of Flowers, or Leaves twiſted together, thickeſt at the middle, and ſuſpended by the two Extremes, whence it hangs down perpendicularly. The Word *Feſtoon* is probably derived of *Feſtus*, L. Feſtival, as being uſually employ'd on feſtival Occaſions, and much us'd at the Gates of Temples, &c. where Feaſts and ſolemn Rejoicings were held.

FEUD. *Littleton* makes a *Feud* a Tenure: The *Civilians* define it to be a Grant of Lands, Honours or Fees made either to a Man at the Will of the Lord or Sovereign, or for the *Feudatory*'s (*i. e.* the Perſon to whom the Grant is made) own Life, or to him and his Heirs for ever; upon Condition that he and his Heirs (in Caſe where the *Feud* is perpetual) do acknowledge the Giver and his Heirs to be their Lord and Sovereign, and ſhall bear Faith and true Allegiance to him and his for the ſaid *Tenure*, and ſhall do ſuch Service to him and his for the ſame, as is between them covenanted, or is proper to the Nature of a *Feud*.

And hence the laſt Volume or Tome of the *Civil Law*, is called the

FEUDS: That is, the Books of Cuſtoms and Service that the Subject or Vaſſal doth to his Prince or Lord for the Lands, Tenures, or Fees that he holdeth of him.

This Part of the Civil Law was not much in uſe in the Old Emperors Time; but it ſeems to be acknowledged by *Juſtinian* in his Novels; where he calls them : Some derive them from the ancient *Clientelas* among the *Romans*, before Chriſt's Time, as *Budeus* in particular: Others bring them from the Practice of *Alexander Severus*, who to encourage them to perpetual Service in his Wars, divided the Lands of the Enemy amongſt his Soldiers. So *Lampridius* in the Life of *Alexander Severus*.

But others refer it to the Time of *Conſtantine the Great*, who ſettled the Lands out of which the Soldiers had formerly their Wages, on them and their Heirs for ever, provided they found and maintained for ever ſuch a Number of Soldiers.

But let its Original be what or when it will, it came but late into the Body of the Civil Law, and to conſtitute, as it doth now, a particular Volume of it.

The Compilers or Collectors of it, were *Obertus de Horto*, and *Giraldus Compagiſtus*, two Senators of *Milan*, who drew it partly from the *Civil Law*, and partly from the ancient Cuſtoms of *Milan*, but without any good Form or Order. For the Original of *Feuds*, ſee *Cujacius*, and Sir *Henry Spelman*'s *Gloſſary*.

FEUDATARY, a *Vaſſal* or Perſon who holds of a ſuperior in Fee, *i. e.* on Condition of yielding Fealty and Homage, or other Service.

FEUDBOTE, a Recompenſe for engaging in a Few'd or Faction, and for the Damages enſuing thereon, it having been the Cuſtom of antient Times for all the Kindred to engage in their Kinſmens Quarrels.

FEUDIST, a Lawyer or Doctor learned or much converſant about Feuds.

FEVILLE *de ſcio*, [in *Heraldry*,] denotes that an Ordinary, as a *Feſſe*, *Pale*, or the like, is indented only on one Side, by reaſon that it then looks like a *Saw*. *F.*

F F [in the *Civil Law*,] ſignifies digeſt; the Reaſon of which is as follows. It was done on the account of the *Greek* Name *Pandect*, which was firſt abbreviated by the Name of Π Π; and to carry the Abbreviation farther, the two Characters were joined into one $\overline{\text{III}}$, which was miſtaken by the *Latin* Copiers for *FF.*

FIBRA *Auris*, the ſame with *Lobus Auris*. L.

FIBRÆ, *Fibres*, by the Anatomiſts, are accounted little round oblong Veſſels, and are either *Muſculous* or *Nervous*. L.

The *Nervous* are ſuch as have no Valves, and by which the Spirits flow conveniently from the Nerves to the ſeveral Parts.

The *Muſculous* Fibres receive the Blood from the Arteries, and diſcharge themſelves into the Veins, and have a great many Valves: They are called Long, Round, or Oblique, from their Form and Situation. Some ſmall Threads interwoven with Trees and Leaves, are called Fibres too; and ſo are the ſmall Threads which ſtick to their Roots, and which faſten the ſmall Roots to the Earth: Alſo, thoſe Strings which go from the bottom of the bulbous Roots are called by this Name; and in general, it ſignifies any ſmall Strings which compoſe the Texture of any Part of an Animal or Vegetable Body.

FIBRES, [in *Phyſick*,] are long fine Parts or Threads of which other natural Bodies are compos'd, and which prevent their being friable or brittle.

FIBRES, [in *Botany*,] are the Filaments or Threads of Plants or Fruits, which are the Modifications of their woody Subſtance, penetrating and terminating in the *Parenchyma* or Pith; but moſt commonly apply'd to the ſlender capillary Roots of Plants.

FIBRILLÆ, little Fibres or Capillaments. *L.*

FIBULÆUS, [in *Anatomy*,] a Muſcle of the Leg, the ſame as *Peroneus Primus*. L.

FIBULA, a Term in Surgery, as the Ancients mention it; for if there be a Wound in the Fleſh, ſays *Celſus*, that gapes, and cannot eaſily be cloſed, it is improper to ſew it, you muſt apply a *Fibula*: But becauſe this way of cloſing the gaping of Wounds by *Fibula's* was uſual amongſt the Ancients, they have not been at all ſollicitous in deſcribing either their Matter or Form. *Guido* tells us, That they made theſe *Fibula's* of Iron Circles as it were, or Semicircles crooked backward on both ſides; the Hooks whereof being faſtned on both ſides to the gaping Wound, anſwered exactly one another; but ſince this muſt be an inſupportable Pain to the poor Patient, it is hardly credible, that they meant any ſuch thing by their *Fibula's*. L.

The Opinion of *Fallopius* is more probable, who tells us, That it was only ſewing up the Wound with a Needle and Thread, which is commonly uſed at this Day.

Sanctorius writes thus, We need not diſcourſe much of *Fibula's*, ſince the Uſe of them is almoſt out of doors; and tho' the Ancients have not deſcrib'd them, yet they forbear not to acquaint us how to uſe them, as *Argenterius* falſly imagines: For not only Phyſicians, but ſome of the Ancients knew the Form of them, ſince *Corn. Celſus* has inform'd us, That *Fibula's* as well as *Sutures*, were made of a Needleful of ſoft untwiſted Silk or Thread, wherewith they ſewed the gaping Lips of the Wound together.

Some call *Acia*, or this Needleful of Thread, *Vinculum*, *Ligatura*, *Colligatio*, *Obligatio*, *Ligamentum*; all which ſignifies tying or binding. Whoever would be further inform'd in this Particular, may conſult the incomparable *Rhodius*, in his Diſcourſe about *Acia*. *Blanchard.*

FIBULA, or *Focile minus*, in *Greek* περόνη, is the leſſer and outer Bone of the Leg; it ſeems to join the Muſcles of the Leg like a Button or Claſp, in Latin *Fibula*; it is the hinder Bone betwixt the Knee and the Feet, ſmaller than the other Bone called *Tibia*, and faſtened outwardly to it, as the Bone called *Radius* in the Arm is to the Cubit; its round Head does not extend as far as the Knee upward, but receives the lateral Knob of the *Tibia* in a ſmall *Sinus* which it hath in its inner Side; downwards it goes farther than the other Bone called *Tibia*, and therefore is altogether as long a Bone as that, tho' much ſmaller. They part in the Middle, becauſe the Muſcles that extend the Feet and Toes are placed there; in which Interval a ſlender, broad, membranous Ligament joins them together lengthways: It is joined likewiſe to the *Tibia*, by its lower End, which is received into a ſmall *Sinus* of it; and then it extends into a large Proceſs which forms the outward Ankle, embracing the external Side of the *Aſtragalus*. L.

FICHANT *Flank*: See *Flank*.

FICHANT *Line of Defence*: See *Fixed Line of Defence.*

FICUS, are the external Protuberances of the *Anus*, otherwiſe called the *Piles*. They are alſo ſometimes called *Mariſcæ*, and *Sycoſes*. L.

FIDD, an Iron Pin uſed at Sea to ſplice or faſten Ropes together. 'Tis made tapering and ſharp at one End. There are alſo Fidds of Wood, which are much larger than the Iron ones. The Pin alſo in the Heel of the Topmaſt, which bears it upon the Cheſs-trees, is called a Fidd. There is alſo a Fidd Hammer, whoſe Handle is a *Fidd*, or made tapering into that form.

FIDEI *Juſſio*, [in the *Civil Law*,] a Security or Guarranty.

FIDE *Juſſor*, [in the *Civil Law*,] is the ſame with *Repromiſſor*, *Adpromiſſor*, *Sponſor*, *Prædes*, and *Vades*; that is, a *Surety*, or one that obliges himſelf in the ſame Contract with a Principal, for the greater Security of the *Creditor* or *Stipulator*.

FIELD-*Fort*: See *Fortin*.

FIELD-*Colours*, are ſmall Flags about a Foot and half Square, which are carried along with the Quarter-Maſter-General, for marking out the Ground for the ſeveral Squadrons and Battalions of an Army.

FIELD-*Pieces*, are ſmall Cannon which are uſually carried along with an Army in the Field; ſuch as three Pounders, Minions, Sakers, ſix Pounders, Demi-Culverins, and twelve Pounders; and theſe being ſmall and light, are eaſily carried.

FIELD-*Staff*, is a Staff carried by the Gunners; 'tis about the Length of an Halbert, with a Spear at the End, which, on each Side, hath Ears ſcrew'd on like the Cock of a Match-lock; and in theſe the Gunners ſcrew lighted Matches when they are on Command. And this is call'd *Arming the Field-Staffs*.

FIELD, [in *Heraldry*,] is the Surface or Face of the Shield or Eſcutcheon, ſo named, as tho' containing the Atchievement antiently acquir'd in the Field of Battle. It is the Ground on which the Colours, Bearings, Furrs, Charges, &c. are repreſented.

FIERI *facias*, is a Writ Judicial that lieth at all times within the Year and Day, for him that hath recovered in an Action of Debt or Damages, to the Sheriff, to command him to levy the Debt or the Damages of his Goods againſt whom the Recovery was had. *L.*

FIFE *Rails*, in a Ship are thoſe that are plac'd on Baniſters on each Side of the Top of the Poop, and ſo along with *Hances* or Falls they reach down to the Quarter-Deck, and to the Stair of the Gangway.

FIFTH, a Term in Muſick, the ſame with *Diapente*; which ſee.

FIGHTS, in a Ship, are the waſte Cloths which hang round about her in a Fight, to hinder the Men from being ſeen by the Enemy; and they call thoſe Bulkheads afore or abaft the Ship, which are put up for Men to ſtand ſecure behind and fire on the Enemy in caſe of Boarding, *Cloſe Fights*.

FIGURAL, or *figurate Numbers*, are ſuch as do or may repreſent ſome Geometrical Figure, in relation to which they are always conſidered; and are either *Lineary*, *Superficial*, or *Solid*; which ſee.

FIGURATE *Deſcant*: See *Deſcant*.

FIGURATE *Counterpoint*, [in *Muſick*,] is that wherein there is a Mixture of Diſcords along with the Concords.

FIGURATIVE *Speeches*, are ways of expreſſing our ſelves, in which we uſe an improper Word, which Cuſtom has applied to another Subject.

FIGURE, [in *Architecture*, &c.] is uſed for the Repreſentation of Things made in ſolid Matters; ſuch as Statues.

FIGURE. The Rectangle under any Diameter and its proper Parameter, is, in the Ellipſis and Hyperbola, called the Figure of that Diameter. *De la Hire*, *Lat. Con. p.* 47, 48.

FIGURE, in Phyſicks, or Natural Philoſophy, is the Surface or terminating Extremes of any Body.

FIGURE [in *Painting*,] is the Lines and Colours that form the Repreſentation of a Man, or other Animal, *&c.*

FIGURE of the *Diameter*, is the Rectangle under any Diameter and its proper Parameter, in an *Ellipſis* and *Hyperbola*.

FIGURE [in *Aſtrology*,] is a Deſcription or Scheme of the State and Diſpoſition of the Heavens at a certain Hour, repreſenting the Places of the Planets and Stars, mark'd down in a Figure of twelve Triangles.

FIGURE, [in *Fortification*,] is the Plan of a fortified Place; or the interior *Polygon*.

FIGURE, [in *Conicks*,] according to *Apollonius*, is the Rectangle made under the *Latus Rectum* and *Tranſverſum*, in the *Hyperbola* and *Ellipſis*.

FIGURE, [in *Geometry*,] is a Space compaſſed round on all Sides, and are either *Rectilineal*, *Curvilineal*, or *Mixt*.

FIGURES *Rectilineal*, are thoſe that have their Extremities all right Lines, as *Triangles*, *Quadrilaterals*, &c. *Polygons* Regular, Irregular, *&c.*

FIGURES *Curvilineal*, are ſuch as have their Extremities crooked, as *Circles*, *Ellipſis*'s, &c.

FIGURES *Mixt*, are ſuch as are bounded partly by right Lines, and partly by crooked ones, as a *Semicircle*, *Segment of a Circle*, &c.

FIGURES [in *Arithmetick*,] are the 9 Digits or Numeral Characters, 1, 2, 3, 4, 5, 6, 7, 8, 9, and 0.

FIGURES [in *Diſcourſe*,] are extraordinary ways of Speaking, different and remote from ſuch as are ordinary and natural; and they are either *Grammatical* or *Rhetorical*.

FIGURES *Grammatical*, are uſed in Conſtruction, when we digreſs from the common and ordinary Rules, as by omitting ſome Word; and leaving it to thoſe to whom we ſpeak, to ſupply it.

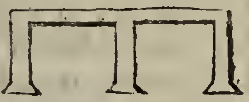
FIGURES *Rhetorical*, ſerve ſometimes to expreſs the Commotions and violent Agitations of the Mind in our Paſſions or warm eager Diſcourſes; ſometimes only to embelliſh and adorn our Speech, or to move the Audience the more pathetically.

FIGURES *Plane*, (or *Plane Surfaces*) are ſuch as are terminated and bounded by right Lines only.

FILACER, FILAZER, is an Officer in the *Common-Pleas*, ſo called, becauſe he files thoſe Writs whereon he makes Proceſs. There are fourteen of them in their ſeveral Diviſions and Counties. They make out all original Proceſs, as well real, as perſonal and mixt; and in Actions merely perſonal, where the Defendants be return'd or ſummon'd, there goeth out the Diſtreſs *ad infinitum* until Appearance: If he be returned *nihil*, there Proceſs of *Capias ad infinitum*, if the Plaintiff will; or after the third *Capias* the Plaintiff may go to the *Exigenter* of the Shire, where his Original is grounded, and have an Exigent or Proclamation made.

FILAMENTS, little, thin, ſlender Rags like Threads, ſuch as ſometimes appear in Urine: Alſo the ſmall Fibres or Threads which compoſe the Texture of the Muſcles, *&c.* or other Parts of any Animal or Vegetable Body, are ſometimes called by this Name.

FILE, or *Label*, [in *Heraldry*,] is of this Form, though ſometimes of more and ſometimes of fewer Points. 'Tis ſometimes born as a Charge in a Coat Armour, of which *Guillim* gives many Inſtances: But 'tis uſually the difference or mark of Diſtinction which the Elder Brother bears in his Coat during his Father's Life.



Some diſtinguiſh *File* and *Label*; calling the *File* the upper Horizontal Line, and the *Label* the Point that iſſues from it.

FILE, [in *Military Language*,] is a row of Men ſtanding one behind or below another from the Front to the Rear.

FILET, a little Member in Architecture, which appears in the Ornaments and Mouldings, and is otherwiſe called *Liſtel*.

FILLET [in *Anatomy*,] is the Extremity of the membranous Ligament under the Tongue, moſt commonly called the *Frænum*, or Bridle.

FILLET, [in *Botany*,] a Term uſed for thoſe Threads commonly found in the middle of Flowers; as in the *Tulip*, *Lily*, &c.

FILLET, [in *Gilding*, *Painting*, &c.] a little Reglet or Rule of Leaf-Gold, drawn over certain Mouldings; or on the edges of Frames, Pannels, *&c.*

FILLET, [in *Heraldry*,] is a fourth part of the Ordinary called a *Chief*, and is placed in the chief Point of the Eſcutcheon.

FILTRATION, is the paſſing a Liquor (in order to its Purification) through a woollen Cloth, or uſually through a Coffin of brown Paper; and this the Chymiſts mean when they direct you to *filtrate* any thing. *L.*

The moſt exact way of *Filtration*, is to take a long piece of linnen or woollen Cloth, and dipping one end of it in the Liquor to be filtrated, hang the other (which muſt be the longer end) over the brims of the Veſſel, and you will ſee the Liquor riſe up and run over the brims through the Body of the *Filtre*; and it will do ſo very pure, and free from all Dregs.

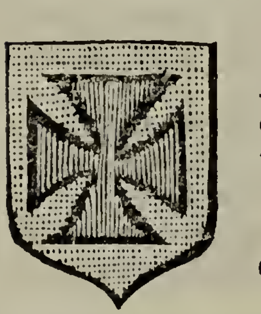
The Cauſe of the aſcent of Liquors in the *filtre*, is generally ſaid to be, that the Liquor ſwelling thoſe parts of the *filtre* that touch it, by entring into the Pores of the Threads of which it is compoſed, doth raiſe them up, make them touch, and wet thoſe that are next above them; and theſe again the next Threads, and ſo on till you come to the brims of the Veſſel, and then the Liquor runs over and deſcends in the other part of the *filtre*, which hangs down, by its own natural Gravity.

But 'tis certain that in very ſlender glaſs Pipes, whoſe Cavities are not much larger than Hairs, Water or any Fluid (but Quickſilver) will aſcend in them to a conſiderable height, as ſoon as ever you dip their ends into it; and in Pipes or Tubes of much larger Bores, the Liquor will be higher (ſomething) within the Tube than without it. And yet here the ſwelling of the Parts of the glaſs Pipe cannot be urged as the Reaſon for the aſcent of the Water in them.

If alſo you will fill a Pipe of a moderate Bore with the powdered *Calx* of a Metal, (as Mr. *Boyle* tried it with *Minium* or red Lead) and then immerſe the lower end of this Tube in Water, the Water ſhall gradually ariſe in the Tube till it attain the height of 30 or 40 Inches; and yet it cannot be ſaid that any of the Particles of this Metalline Powder, are ſwelled at all by the Water.

Therefore the true Cauſe of the aſcent of Water in a *filtre*, is probably this: That every *filtre* being compoſed of a great Number of long ſmall ſolid Bodies, which lie very cloſe together, the Air getting in between them, loſes much of its preſſure, and cannot gravitate there ſo ſtrongly as it doth on the Fluid without them: Wherefore the Parts of the Water between the Threads of the *filtre* muſt be preſſed upwards, and aſcend till they come ſo high, as by their Weight to counter-balance the general preſſure on the other Parts of the Surface of the Water.

FIMBRIA, [in *Anatomy*,] the Extremities of the *Tubæ Fallopianæ*, ſo called from their reſemblance to a fringed Border.



FIMBRIATED, a Term in *Heraldry*, ſignifying that an Ordinary is edged round with another of a different Colour, as thus.

He beareth *Or*, a *Croſs*, *Patee Gules fimbriated Sable*.

FINAL *Cauſes*, are ſuch great, wiſe, and good Ends, as God Almighty, the Author of Nature, had in Creating and Proportioning, in Adapting and Diſpoſing, in Preſerving and Continuing, all the ſeveral Parts of the Univerſe. On this Subject the Honourable Mr. *Boyle* hath a very good Diſcourſe: And that good Mathematician Mr. *Keil* of *Oxford*, in his Refutation of *Burnet's Theory of the Earth*, ſhews that final Cauſes are the beſt Principles for Men to regulate their philoſophical Theories and Speculations by.

FINE, [in *Common Law*,] hath divers Applications; for ſometimes 'tis uſed for a formal or ceremonious Conveyance of Lands or Tenements, or of any Things inheritable, being *in eſſe tempore finis*, to the end to cut off all Controverſies. Others define it to be a *final* Agreement had between Perſons concerning any Lands or Rent, or other thing whereof any Suit or Writ is between them hanging in any Court. A *Fine* hath in it five eſſential Parts.

1. The Original Writ taken out againſt the Cogniſor.
2. The King's Licenſe, giving the Parties Liberty to accord; for which he hath a *Fine* called the *King's Silver*, being accounted a Part of the Revenue of the Crown.
3. The Concord it ſelf, which thus beginneth, *Et eſt Concordia talis, &c.*
4. The Note of the *Fine*, which is an abſtract of the original Concord, and beginneth in this manner: *Scil. inter R. Querentem & S. & E. uxorem ejus, deforciantes, &c.*
5. The Foot of the *Fine*, which beginneth thus: *Hæc eſt* finalis *concordia facta in curia Domini Regis apud* Weſtmonaſterium *a die Paſchæ in quindecem dies, anno, &c.* So as the Foot of the *Fine* includeth all, containeth the Day, Year, and Place, and before what Juſtice made.

This Word *Fine* ſometimes ſignifies a Sum of Money paid for an Income to Lands or Tenements let by Leaſe; and ſometimes an Amends, Pecuniary Puniſhment, or Recompence upon an Offence committed againſt the King and his Laws, or againſt the Lord of the Manor.

FINE *adnullando levato de Tenemento quod fuit de antiquo dominico*: Is a Writ to the Juſtices for the diſannulling of a *Fine* levied of Lands holden in ancient Demeſne to the Prejudice of the Lord. *L.*

FINE *capiendo pro terris, &c.* Is a Writ lying for one that upon Conviction by a Jury, having his Lands and Goods taken into the King's Hands, and his Body committed to Priſon, obtaineth favour for a Sum of Money, *&c.* to be remitted his Impriſonment, and his Lands and Goods to be redelivered unto him. *L.*

FINE *force*, ſignifies an abſolute Neceſſity or Conſtraint not avoidable; as when a Man is conſtrained to do that which he can no way avoid, we ſay, He doth it *de fine force*.

FINE *levando de Tenementis tentis de Rege in Capite, &c.* is a Writ directed to the Juſtices of the *Common Pleas*, whereby to licence them to admit of a *Fine* for Sale of Lands holden *in Capite*. L.

FINE *non capiendo pro pulchre placitando*, is a Writ to inhibit Officers of Courts to take *Fines* for fair Pleading. *L.*

FINE *pro rediſſeiſina capienda, &c.* is a Writ that lieth for the Releaſe of one laid in Priſon for a *Reſeiſin*, upon a reaſonable Fine. *L.*

FINES *for Alienation*, are reaſonable Fines paid to the King by his Tenants in Chief, for Licence to alien their Lands.

FINERY, is the Name of one of the Fires in Forges in an Iron-work. See *Iron*. At the *finery*, by the working of the Hammer, they bring the Iron into what they call *Blooms* and *Anconies*.

FINISHING, [in *Architecture*,] is frequently apply'd to a Crowning, Acroter, *&c.* rais'd over a Piece of Building, to terminate, finiſh or compleat it.

FINITE, is what hath fix'd and determined Bounds or Limits ſet to its Power, Extent or Duration.

FINITOR, the ſame with *Horizon*; and 'tis ſo called, becauſe the Horizon finiſhes or terminates your Sight, View, or Proſpect.

FIRE: See *Light*. There is an Account of the Generation of Fire, by Mr. *Malbranche*, in the Fr. Memoirs for the Year 1699, which is ingenious enough; but it ſeems to depend entirely on the *Hypotheſis* of *Deſcartes*. In the ſame Book, Mr. *Amontons* ſhews a Method of making the

Force of Fire ſupply that of Men or Horſes in Engines, *p.* 112.

Of the Properties of Fire in General.

1. *Fire* eaſily penetrates thro' all Bodies, however denſe and hard they are, as appears from all the Parts of a Body being heated by the Application of *Fire* to it.

2. *Fire* moves very ſwiftly, as appears by Aſtronomical Obſervations.

3. It unites it ſelf to Bodies; for if they are heated they expand and ſwell.

4. It is attracted by Bodies at a certain diſtance from it, as appears by Experiments.

5. All Bodies, for ought we know, contain *Fire* in them; for by rubbing two Bodies againſt one another, they become hot, and are often ſet on fire by violent Attrition; by which means *Fire* may be ſeparated from Body, but can by no means be generated that way.

6. Heat, in a hot Body, is the Agitation of the Parts of the Body, and the *Fire* contain'd in it; by which Agitation, a Motion is produced in our Bodies, which excites the Idea of Heat in our Mind. Heat, in reſpect of us, is nothing but that Idea; and in the hot Body, is nothing but Motion.

7. Hence the burning of Bodies is a Separation of their Parts, by the mutual Action of the *Fire*, and thoſe Parts on each other; by which ſome of the Parts are carried off in *Fire*, *Flame*, and *Smoak*.

8. All Bodies are dilated by the Action of *Fire*; but that Dilatation changes as the Heat changes, ſo that it ſeems rather to depend upon the Motion than the Quantity of the *Fire*; for Bodies are expanded as well by rubbing, as by applying *Fire* to them externally.

9. Liquids as well as Solids are dilated by Heat; which may be proved, by taking a glaſs Ball that has a long narrow Tube for its Neck, and fill it with ſome Liquor to what height you pleaſe in the Tube; then heating the Ball, the Liquor will aſcend in the Tube.

10. From the Expanſion of Bodies it is evident, that the Particles of which Bodies conſiſt, from the Action of the *Fire*, acquire a repelient Force, by which they endeavour to fly from each other; contrary to that Force by which the Particles adhere to each other. As long as this laſt Force is ſtronger than the other, the Particles cohere more or leſs, according to the different Degree of Heat. When the repellant Force is almoſt equal to the attractive, the Particles, which were before firmly join'd, ſcarcely cohere, yield to any Impreſſion, and are eaſily moved one among another.

11. Hence a ſolid Body is chang'd into a Liquid by Heat, which may be obſerved in all Bodies that are liquified by Heat, and retutn to their former State upon the Diminution of the Heat: And it is a Queſtion whether all Fluidity is not owing to Heat.

12. Heat may be ſo increas'd that in ſome Bodies the attracting Force is overcome by the repelling Force; in which Caſe the Particles fly from each other, that is, acquire an elaſtick Force, as the Particles of Air have; which Elaſticity is even encreas'd in the Air by Heat, as may be ſeen in Smoak and Vapours.

13. Hence a Sky-Rocket riſes up into the Air; becauſe the Gun-Powder, being ſet on fire, acquires an Elaſticity; and its Parts endeavour to recede every way: But the Caſe of the Rocket being open at one end, it is leſs preſs'd that way, and conſequently at the other end the Preſſure prevails, and carries up the Rocket.

FIRE-*Maſter*, in our Train of Artillery, is an Officer that gives the Directions and the Proportions of the Ingredients for all the Compoſitions of Fire-Works, whether for Service in War, or for Rejoycings and Recreations. His Orders are given to the Fire-Workers and Bombardeers, who are obliged to execute them.

FIRE-*Workers*, are ſubordinate Officers to the Fire-Maſters; but they command the Bombardeers: They receive the Orders from the Fire-Maſters, and ſee that the Bombardeers execute them.

FIRMAMENT, by ſome Aſtronomers is taken for the Orb of the fixed Stars, or an eighth Heaven: But more properly, 'tis that Space which is expanded or arched over us above in the Heavens.

FIRMNESS, or *Solidity*, Mr. *Boyle* deſcribes to conſiſt principally in this, That the Particles compoſing ſuch Bodies as we call Firm or Solid, are pretty groſs; and either are ſo much at Reſt, or are ſo intangled one with another, that there is a mutual Cohæſion of their Parts; and that they cannot flow from, ſlide over one another, or diffuſe themſelves every way from one another, as the Parts of Fluid Bodies can; and conſequently the Figure of firm or ſolid Bodies, ought rather to be attributed to the Connexion of the Parts that compoſe them, than to the Impreſſions of outward Bodies.

And in his Hiſtory of *Firmneſs*, he proves by Experiments, and good Conſiderations upon them, the ſeveral Parts of the above-given Deſcription. As,

1. He ſhews the *Groſſneſs of Parts* are (*cæteris paribus*) requiſite to Firmneſs or Solidity, becauſe *Minuteneſs* he had before proved, was neceſſary to the Parts of fluid Bodies.

2. Reſt alſo, and *juxta Poſition* of Parts, he demonſtrates by many Experiments, are in a Degree abſolutely requiſite to produce this Effect. And,

3. The Preſſure and Weight of the incumbent Atmoſphere he judges contributes much toward it, becauſe of the ſtrong Adherence of two Pieces of poliſhed Glaſs, or Marble together, in the open Air, which will immediately ſeparate in the exhauſted Receiver.

4. The Texture of the Bodies, and the Figures of their Parts may contribute much to this Effect; as if they be of an hooked Form, or any way entangled one in another, they muſt be disjoined with difficulty, and conſequently will be in the Form of a Solid.

And 'tis a very ſurprizing Experiment, that two Parts of Spirit of Wine, mixed with one of Spirit of Hartſhorn, or Urine, (both highly rectified) will, in a Minute, unite into a conſiſtent Body, or white *Coagulum*, which ſome call *Offa alba.*

FIRME, the ſame with a Farm, or Land and Tenements hired at a certain Rate. But it antiently ſignified the Reception and Entertainment of the King, or any other Lord and his Retinue; and frequently in the Doomſday Book, a Condition of Tenure was *pro firma per unum diem*, or *pro firma per unam noctem*: And ſo, becauſe in the *Saxon*, and part of the *Norman* Times, the Rent of Lands was paid in Proviſions, *Firma* ſignified the Profits and Rent of an Eſtate: But *Henry* II. for better Convenience, alter'd this Cuſtom into an Equivalent of Money; which pecuniary Rent was ſtill call'd *firma Regis.*

FIRST *Mover*: See *Primum Mobile.*

FIRST-*Fruits*, *Primitiæ*, are the Profits of every Benefice for one Year, given before the Reformation to the Pope; but by 26 *H.* VIII. *c.* 3. tranſlated to the Crown: And by that Act, he which enters on any ſpiritual Living before he pays or compounds for it, on Conviction, forfeits the double Value thereof. Every Clerk therefore, before his Induction, (or ſoon after,) ſhould go himſelf with one Friend of the City of *London*, Inns of Courts, or Parts adjacent; or ſend two ſuch Friends for him, to the Firſt-Fruits Office, and there enter into Bond to pay the firſt Fruits of his Benefice within two Years next enſuing, at four equal Half-yearly Payments: Only one tenth of the whole yearly Sum, mention'd in the Queen's Books, to be deducted; becauſe that muſt be paid by it ſelf the firſt Year. Formerly four Bonds were given for the four ſeveral Payments; but by Statute 2 and 3 of Queen *Ann*, but one Bond only is appointed to be given; and the Rates of all Benefices, according to the King's Books, are declared unalterable. The Succeſſor is chargeable with Arrears of Tenths due from his Predeceſſor; and conſequently, by 27 *H.* VIII. *c.* 8. is impower'd to diſtrain his Predeceſſor's Goods, being upon the Benefice; and hath likewiſe a good Action at Law, againſt him, or his Executors. The 2d. of Queen *Ann*, *cap.* 11. ſettles upon a *Corporation*, the *firſt Fruits* of all Benefices for the *Maintenance of the poor Clergy*; which is called the *Corporation of the Bounty of Queen* Ann.

FISC, FISCUS, [in the *Civil Law*,] the Treaſury of a Prince or State; or that to which all Things due to the Publick fall.

FISH-*Block*, in a Ship, is the Block which is hung in a Notch at the End of the *Davit*, and ſerves to hale up the Fluke of the Anchor to the Ship's Bow.

FISHES. *Rondeletius* diſtinguiſhes Fiſhes, from the Places where they are found, into *Sea Fiſh*, *River Fiſh*, and *Lake* or *Pond Fiſh*; and of theſe he makes ſome other Subdiviſions. But Mr. *Willoughby* ſaith rightly, That *Fiſhes* are much better divided by *Ariſtotle* into theſe three Kinds, *Cetaceous*, *Cartilaginous*, and *Spinous*.

The *Cetaceous* Kind (which are ſometimes therefore call'd the *Bellæ Marinæ)* have Lungs and Breath like Quadrupedes; they copulate alſo like them, conceive and bring forth their Young alive, whom they ſuckle with their Milk.

The *Cartilaginous* Sort, are produc'd from large Eggs like Birds, which are excluded the Womb alſo like thoſe of Birds.

The *Spinous* Kind, are alſo *Oviparous*, but their Eggs are ſmaller; and they have *Spinæ* up and down in their Fleſh to ſtrengthen it.

But he thinks it would be yet more proper to divide Fiſhes into the *Cetaceous* Kind, or ſuch as *breathe with Lungs*, and into ſuch as *breathe with Gills*. And then, to ſubdivide thoſe that *breathe with Gills*, not into *Cartilaginous* and *Spinous*, but into *Viviparous* and *Oviparous*.

The *Viviparous* Kind, that *breathe with Gills*, he ſubdivides into *Long*, ſuch as the *Galei*, and *Canes* or *Sharks*, and *Dog-Fiſh:* And the *Broad Kind*, ſuch as the *Paſtinacæ*, *Rajæ*, *Squatinæ*, &c. all whoſe Subdiviſions he gives in his Chapter of *Cartilaginous Fiſhes* in general.

The *Oviparous* Kind, that *breathe with Gills*, are the moſt numerous; and theſe he ſubdivides into ſuch as are what we uſually call *Flat Fiſh*; and ſuch as ſwim with their Backs upright; or at Right Angles to the Horizon.

The *Plain* or *Flat Fiſh* Kind, called uſually *Plani Spinoſi*, are either *Quadrati*, as the *Rhombi* and *Paſſeres*; or *Longiuſculi*, as the *Solæ*.

Such as *ſwim with their Backs erect*; are either *Long* and *Smooth*, and *without Scales*, as the *Eel* Kind; or *Shorter* and leſs *Smooth:* And theſe have either but *one Pair of Fins* at their Gills, which are call'd *Orbes* and *Congeneres*; or elſe *another Pair of Fins* alſo on their Bellies. And this latter Kind he divides into two others; 1. Such as have *no prickly Fins on their Backs*, but *ſoft* and *flexile ones*. 2. Such as have *prickly Fins upon their Backs*.

Thoſe Fiſhes which have only ſoft and flexile Fins on their Backs, may be divided into ſuch as have *Three*, *Two*, or *but One ſingle Fin* there. No Fiſh but the *Aſelli* have *three* Fins on their Backs.

Fiſhes with *two* Fins on their Backs, are either the *Truttaceous* or *Trout* Kind, or the *Gobionite*, or *Loch* or *Gudgeon* Kind.

Fiſhes with *but one ſoft Back Fin*, are of three Sorts; the firſt Kind have one long continued Fin from Head to Tail, as the *Hipparus* of *Rondeletius*, &c. the ſecond have this Fin, but ſhort, and placed juſt in the middle of their Back; and theſe are either *Marine*, as the *Herring* Kind; or *Fluviatile*, as thoſe we call *Leather-mouthed Fiſhes*; ſuch as *Carp*, *Tench*, &c.

Such Fiſhes as have prickly Fins on their Backs, are of two Kinds:

1. Such as have two prickly Fins on their Backs; and in theſe the anterior *Radii* of their Fins are always prickly: Or,

2. Such as have but one prickly Fin there.

Mr. *Willoughby* gives us this Catalogue of our *Engliſh* Fiſhes.

1. Of the *Long Cartilaginous* Kind, are the
1. *Canis Carcharius*, or *Lamia*, the *white Shark.*
2. *Galeus Glaucus Rondoletii*, the *blue Shark.*
3. *Canis Galeus Rondeletii*; called a *Tope* in *Cornwal.*
4. *Galeas acanthias ſive Spinax*, the *prickled Dog or Hound Fiſh.*
5. *Galeus ſeu Muſtela lævis*, the *ſmooth* or *unprickled Hound Fiſh.*
6. *Catulus major*, *vulg. Canicula Ariſtotelis*, the *rough Hound*; in *Cornwal*, the *Bounce.*
7. *Catulus minor*, the leſſer *Hound Fiſh*, or *Morgay.*

2. Of the *plain Cartilaginous Kind*, are the
1. *Raja levis undulata*, the *Skate* or *Flare.*
2. *Raja Clavata*, the *Thornback.*
3. *Raja Aſpera Noſtras*, the *White-horſe.*
4. *Squatina*, the *Angel* or *Monk-Fiſh.*
5. *Rana Piſcatrix*, the *Toad Fiſh* or *Sea-Devil.*

3. Of the *plain Spinous Kind*, are the
1. *Rhombus Maximus Aſpero Squammoſus*, the *Turbot* or *Brett.*
2. *Rhombus non aculeatus ſquammoſus*; in *Cornwal* call'd the *Lug-aleſe.*
3. *Paſſer Bellonii*, the *Plaſe.*
4. *Paſſer Aſper ſive Squammoſus*, the *Dab.*
5. *Paſſer Fluviatilis ſive Amphibius*, the *Flounder*, *Fluke*, or *Butt.*
6. *Hippogloſſus Rondeletii*, the *Holy-Butt*; call'd in the *North* the *Turbot.*
7. *Bugloſſus* or *Solea*, the *Sole.*

4. Of the *Eel Kind*, we have.
1. *Lampetra major*, the *Lamprey*, or *Lamprey Eel.*
2. *Lampetra parva* and *Fluviatialis*, the *Lampern.*

3. *Anguilla*, the *Common Eel.*
4. *Conger*, the *Conger* or *Sea Eel.*
5. *Ammodytes Geſneri*, the *Sand Eel* or *Launce.*
6. *Gunnellus Cornubienſis*, the *Butter Fiſh.*
7. *Muſtela vulgaris Rondel*, the *Sea Loach* or *Whiſtle-Fiſh.*
8. *Muſtela Fluviatilis*, the *Eel Pout* or *Turbot.*
9. *Lupus Marinus*, the *Wolf Fiſh*, or *Sea Wolf.*
10. *Alauda non criſtata*, the *Sea Lark*; called in *Cornwal Mulgranoc* and *Bulcard.*
11. *Alauda Criſtata*, the Creſted *Sea Lark.*
12. *Liparis Rondeletii.*
13. *Gobio fluviatilis*, the *Bull-head* or *Millers-thumb.*
14. *Scorpæna bellonii ſimilis*, the *Dutch-Pots-Hog*: the *Corniſh* Boys call it *Father-Laſher.*

5. Of the Kind of Fiſhes *wanting the Belly Pair of Fins*; we have,

1. *Mola Salviana*, the *Sun Fiſh.*
2. *Acus Ariſtotelis, Species major.*
3. *Acui Ariſtotelis Congener*, the *Sea Adder.*
4. *Xiphias, ſeu Gladius piſcis*, the *Sword Fiſh.*

6. Of the *non Spinous Kind* of Fiſhes, with *three unprickly ſoft Fins* on their Backs, we have,

1. *Aſellus vulgaris major*, the *Codfiſh*, or *Kaling.*
2. The *Whiting Pollack.*
3. *Aſellus niger*, the *Colefiſh*, or *Rawling Pollack.*
4. *Aſellus Lucus*, the *Bib* or *Blinds.*
5. *Aſinus Antiquorum*, (Turn.) the *Haddock.*
6. *Aſellus mollis major*, the *Whiting.*

7. Of the *non Spinous Kind*, with only *two ſoft Fins* on their Backs; are found with us,

1. *Merlucius*, the *Hake.*
2. *Aſellus longus*, the *Ling.*
3. *Thynnus*, ſee *Thunnut*; the *Tunny*, or *Spaniſh Mackrel.*
4. *Scomber*, the *Mackrel.*
5. *Thymallus*, the *Grayling*, or *Umber.*
6. *Albula Salmoni ſimilis*, the *Guinnard.*
7. *Albula Harengi formis*, the *Schelley.*
8. *Salmo*, the *Salmon.*
9. *Salmulus*, the *Samlett* or *Branlin.*
10. *Salmo Griſeus*, the *Gray.*
11. *Trutta Salmonata*, the *Salmon Trout.*
12. *Trutta Lacuſtris*, the *Scurf*, or *Bull Trout.*
13. *Trutta fluviatilis duum generum*, the *Trout.*
14. *Umbia minor Geſn*, the *Red Charr*, or *Welſh Torgoch.*
15. *Carpio Lacus Benaci*, the *Guilt* or *Guilt Charr.*
16. *Eperlanus ſeu Violæ*, the *Smelt.*
17. *Golius Niger*, the *Rock-fiſh* or *Sea Gudgeon.*
18. *Lumpus Anglorum*, the *Lump* or *Sea Owl.*
19. *Cataphractus Schonfeldii*, in the *Weſt* of *England*, a *Dog.*

8. Of the *non Spinous Kind*, with only *one Fin* on the Back; we have,

1. *Harengus*, the *Herring.*
2. *Harengus minor*, the *Pilchard*, called alſo *Calchis.*
3. *Encraſſicholus*, the *Anchoris.*
4. *Aloſa ſeu Clupea*, the *Shad* or Mother of Herrings.
5. *Sardina*, the *Sprat* or *Sparling*; which is nothing elſe but the *Fœtus* of a *Herring.*
6. *Acus Vulgaris*, the *Garr-fiſh*, or *Horn-fiſh.*
7. *Sturio*, the *Sturgeon.*
8. *Lucius*, the *Pike* or *Pickrel.*
9. *Cyprinus*, the *Carp.*
10. *Cyprinus Latus*, the *Bream*, or *Bruma.*
11. *Tinca*, the *Tench.*
12. *Orfus Germanorum*, the *Rudd*, *Oerve*, or *Nerfling.*
13. *Capito, ſeu Cephalus*, the *Chub* or *Chevin.*
14. *Barbus*, the *Barbel.*
15. *Leuciſcus*, the *Dace* or *Dare.*
16. *Rutilus, ſeu Rubellas*, the *Roach.*
17. *Alburnus*, the *Bleak* or *Bley.*
18. *Gobius fluviatilis*, the *Gudgeon.*
19. *Bobites fluviatilis barbatula*, the *Loche.*
20. *Varias, ſeu Phoxinus lævis*, the *Pink* or *Minnow.*

The laſt Twelve of theſe are called by us *(Malacoſtomi) Leather-mouthed* Fiſhes; becauſe they have no Teeth in their Jaws, but only deep down in their Mouths.

9. Of the *ſpinous Kind* with *two Fins* on their Back, of which the foremoſt is *aculeate*; we have,

1. *Lupus*, the *Baſſe.*
2. *Mugil*, the *Mullet.*
3. *Gurcardus Piſcis*, the *Gray Garnard.*
4. *Hirundo Aldrovandi*, the *Tub-fiſh.*
5. *Cuculus Aldrovandi*, the *Red Garnard* or *Rotchet.*
6. *Lyra prior Rondel*, the *Piper.*
7. *Mullus major*, the *Sur-Mullet.*
8. *Draco, ſive Araneus Plinii*, the *Spider.*
9. *Frachurus*, the *Scud.*
10. *Perca fluviatilis*, the *Perch.*
11. *Faber Piſcis*, the *Dorge.*

10. Of the *Aculeate Kind*, with only one Fin on the Back, whoſe *Radii* are ſome prickly, and ſome ſoft; we have,

1. *Aurata*, the *Gilt-head*, or *Gilt-poll.*
2. *Pagrus*, the *Bream.*
3. *Turdus vulg.* the *Old Wife* or *Wraſs.*
4. *Perca fluviatilis minor, ſeu Aurata*, the *Ruff.*
5. *Piſcis Aculeatus vulgaris, ſeu pungitius Aberti*, the Common *Prickle-Back*, or *Sharpling*, or *Banſtickle.*
6. *Piſcis aculeatus minor*, the leſſer *Prickle-Back*

11. Of the *Cetaceous Kind*, we account only,

1. *Balæna Britannica Antiquorum*; which now ſeems to be gone from our Seas, and we ſcarce know what kind of Fiſh it was.
2. *Balæna vulg. Rondel*, the *Whale*, which is ſometimes found ſtranded on our Coaſts; or rambles up our Rivers.
3. *Delphinus Antiquorum*, the *Dolphin*, very rarely, but ſometimes ſeen here.
4. *Phocæna*, the *Porpuſs*, call'd by *Schonfeld*, the *Northern Dolphin.*

FISHES, are Pieces of Timber uſed to ſtrengthen the Maſts or Yards aboard of a Ship, when they begin to fail in a Streſs of Weather. They both nail the Fiſhes on with Iron Spikes, and alſo *would* them, as they call it; that is, wind Ropes hard round about them. There is alſo a Tackle called,

The Fiſh, which hangs at the End of the *Davit* by the *Strap* of the *Block*, in which is the Runner of the Fiſh-hook; by which Means the Fluke of the Anchor is haled up to the Ship's *Bow*, or *Chain-waile.* Perhaps this Tackle was called a Fiſh, from that which the Ancients called the *Dolphin*, which was a pointed and vaſtly heavy Piece of Iron, and which they uſed to heave up by a Tackle to a good Height, and then, when they came near enough to the Enemy's Ship, let it fall at once, which would break or pierce a Hole through the Bottom of the Enemy's Veſſel and ſink her.

FISSURA *Oſſis*, is the Term for a Cleft or a Fracture of a Bone lengthways. *L.*

FISSURES, the ſeveral *Layers* or *Strata*, of which the Body of our Terreſtial Globe is compoſed, are diſtinguiſhed from one another, and divided Horizontally or Parallelly by ſome Interruptions which they call *Fiſſures*; and theſe are interſected again by other Fiſſures, which, by reaſon of their Situation, are called *Perpendicular Fiſſures.* See *Woodward's Nat. Hiſt. of Earth*, *p.* 10.

FISTULA, is a long Cavity, ſtrait or winding about, in any Part of the Body, being a narrow and callous Ulcer of difficult Cure, proceeding uſually from an Apoſteme. *L. Blanchard.*

Fiſtula's differ from winding Ulcers in this, that *Fiſtula's* are callous and hard, but Ulcers are not. *Blanchard.*

FISTULA *Lachrymalis*, is when the *Punctum Lachrymale*, the little Hole in the Bone of the Noſe, through which the Liquid Matter of the Tears paſſes to the Noſtrils, is grown hard and callous from an Ulcer of the *Carunculæ*, (which are *Glandules* placed at the greater Corners of the Eye) by which means there happens a continual Defluxion of Tears. *Blanchard. L.*

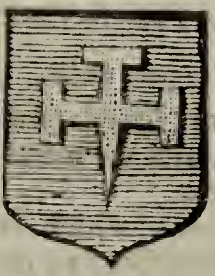
FISTULA *Pulmonis*, in ſome Writers, is the ſame with the *Aſpera Arteria.* L.

FISTULA *Sacra*, is that Part of the Back-bone which is perforated. *Blanchard. L.*

FISTULA *Urinaria*, the ſame with the *Urethra.* L.

FISTULAR, } [*Fiſtularis*, L.] a Term ap-
FISTULOUS, } ply'd by Surgeons to Wounds and Ulcers, which degenerate into *Fiſtula's.*

FISTULAR *Flower*, [in *Botany*,] are thoſe made up of many long, hollow, ſmall Flowers like Pipes; all divided into large Jaggs at the End.



FITCHEE, the Term in *Heraldry*, when the lower Part of any Croſs is ſharpened into a Point, thus:

Azure a Croſs Potent Fitchee.

FITS *of eaſy Reflexion* of the Rays of Light; ſo Sir *Iſaac Newton*, in his *Opticks*, calls the Diſpoſition of the Rays to be reflected at any Time; and their Diſpoſition to be tranſmitted, he calls,

FITS *of eaſy Tranſmiſſion:* And the Space it paſſes between every Return and the next Return, he calls the *Interval of its Fits.* Opt. Book II. P. 3. See *Light.*

FIXATION, [in *Chymiſtry*,] a peculiar Preparation of Mercury, whereby it is put in a Condition to bear the Fire without evaporating, or the Hammer without flying or ſeparating.

FIXED *Line of Defence*, [in *Fortification*,] is drawn along the Face of the Baſtion, and terminates in the *Courtin.*

FIXED *Signs* of the Zodiack, according to ſome, are *Taurus*, *Leo*, *Scorpio*, and *Aquarius.* And they are ſo called, becauſe the Sun paſſes them reſpectively in the Middle of each Quarter, when that particular Seaſon is more ſettled and fixed than under the Sign that begins or ends it.

FIXED *Stars.* The Phænomena's that have been obſerv'd by Aſtronomers about the *fixed Stars* are theſe:

1. That they all, together alſo with the Planets, or erratick Stars, and all the Celeſtial Bodies, do appear every Day to riſe and ſet; and to move with a circular Motion from Eaſt to Weſt; the Plains alſo of theſe diurnal circular Revolutions being at Right Angles to the Earth's Axis, or parallel to the Equator.

All which is fairly and eaſily accounted for, by ſuppoſing our Earth to revolve round its own Axis in 24 Hours, from Weſt to Eaſt. But the Eye of the Spectator moving together with the Earth, that muſt appear to him immoveable; as a Ship doth to thoſe that are in it, till by Obſervation and Judgment they come to find it otherwiſe.

Provehimur Portu, Cælique ac Aſtra recedunt.

3. It hath been obſerv'd of the *fix'd Stars*, that beſides the former apparent Motion round the Earth in 24 Hours, they alſo ſeem to have another which is quite contrary to that; for they appear to change their Longitude or Diſtance from the beginning of *Aries*, forward according to the Order of the Signs, or to move *in Conſequentia* by a ſlow Motion of about a Degree in 70 Years. So that thoſe Stars which in *Hipparchus*, nay even in *Ptolemey*'s Time, were in *Aries*, are now found to be in *Taurus*; and ſo on all round the Zodiack.

As to which, we muſt conſider that the *Terminus à quo*, or Point from whence this ſlow Motion is propagated, being the Vernal Equinoctial Point, or the Eaſtern Interſection of the Equinoctial and Ecliptick; 'till it can be determin'd whether this Point be fix'd or moveable, it cannot be known whether the Stars move from that, or that Point from them: And indeed the latter is much more probable, when we compare with this what certainly happens in other Inſtances in the Heavens. For 'tis well known now, that the *Nodes* of the Orbits of the ſecondary Planets, or the Points of their Interſection with the Ecliptick, do ſhift and change, and go a little backward, or move *in Antecedentia*; as is very evident in the *Nodes* of the Lunar Orbit: Why may it not be ſo then with the *Nodes* of the Earth's Orbit? The *Præceſſion* therefore of the Terreſtial Equinoxes may ſerve to account for this Motion of the *fixed Stars*, ſince the Quantity will be found the ſame in both. For from the *Newtonian* Principles, it appears, the Terreſtrial *Nodes* ſhould go backward, after the Rate of about 50 Seconds every Year; and juſt ſo much the *fixed Stars* have been obſerv'd to move forward every Year.

3. It hath never been obſerv'd that the *fixed Stars* have changed their Latitude, though, as before, they annually do their Longitude.

Which is a difficult Thing to account for without the New Aſtronomy. For allowing the former Motion of the *fixed Stars*, how can they all, and always, keep the ſame Diſtance from the Ecliptick? 'Tis true, the Celeſtial Orbits are all found to be in immovable Plains, but thoſe Plains are different, and do interſect each other with different Angles; nor is there any two of the primary Planets, whoſe Orbits are in the ſame Plain. If therefore theſe Stars had any ſuch Motion, as that ſeeming one of Longitude, 'tis very likely that their Orbits would be poſited with reſpect to ſome one great and peculiar Plain, and which ſhould be inclin'd in a peculiar Manner to the Plains of the other Orbits, ſo as that their Orbits would interſect the Ecliptick, and the Orbits of the Planets; but ſince there is no ſuch Thing obſerv'd; 'tis likely, that Motion of Longitude belongs not to the Stars, but to the *Nodes* of the Earth's Orbit, as has before been ſhewn. But allowing that Receſſion of the Earth's *Nodes*, 'tis evident why the Stars ſhould have (or appear to have) a Motion in Longitude; but none in Latitude; becauſe that Receſſion of the Terreſtrial *Nodes* happens without any Change of the Earth's annual Motion as to the Plain of the Ecliptick; for if the Stars themſelves are immoveable, and the Earth's Orbit (or the Ecliptick) be always an immoveable Plain, there can be no ſuch Thing as any Change in the Latitude of the Stars.

4. The Diameters of the *fixed Stars* are very ſmall, ſcarcely ſenſible even in the largeſt Teleſcopes; ſeen through which, they appear but like lucid Points, and without any of thoſe adſcititious Rays which ſtrike the naked Eye.

5. The *fixed Stars* have no *Diurnal Parallax*, but, as hath lately been diſcover'd by Dr. *Hook* and Mr. *Flamſtead*, a ſmall *Annual one*; and conſequently their Diſtance muſt be immenſly great. In order to gueſs at which, Mr. *Huygens* ſuppoſes the Dog-Star, *Syrius*, to be about the Bigneſs of our Sun; and then conſiders how remote our Sun muſt be placed, before his Diameter would appear as little as that of *Syrius*: And on the whole, he concludes, that *Syrius*, and the neareſt *fixed Stars*, cannot be leſs diſtant than 150000000000 of our Miles from the Earth, which is 27000 times as far off as our Sun is from us.

And by that annual Parallax which hath been found to belong to the *fixed Stars*, and is about 47 Seconds, they conclude, that they are diſtant from us about 9000 times the Radius of the *Magnus Orbis*, *i. e.* 9000 times as far off as the Sun; or about 500000000000 Miles.

6. The *Milky Way* is a circular Tract in the Heavens, extending over a very conſiderable Part of them; and is ſo call'd, becauſe it looks white and brighter than any other part of the Sky. And this, by the Teleſcope, is diſcoverd' to be a Congeries of very ſmall Stars, which are ſingly inconſpicuous to the naked Eye.

7. There are above 1000 Stars which are viſible to the naked Eye; but the Teleſcope hath diſcover'd about 20 times as many more: And the larger and better thoſe Glaſſes are, the more are ſtill diſcover'd.

8. The Light of the *fixed Stars* is much more ſtrong and vivid than that of the Planets, tho' their apparent Diameters are much leſs; becauſe the Stars, like the Sun, ſhine by their own Native Light, but the Planets only by Reflection from the Sun.

9. The *fixed Stars* are obſerv'd to twinkle much more than the Planets, becauſe their apparent Diameters being very inſenſibly ſmall, the leaſt Atom or Particle of Matter floating in our Atmoſphere, will hinder (for a Moment) the Stars being entirely viſible. As the groſs Smoak of a Chimney will do by the Planets themſelves, which in ſuch a Caſe will twinkle.

That there are Changes and Alterations among the *fixed Stars*, hath appear'd by the Obſervations of our modern Aſtronomers.

In *Phil. Tranſ. N.* 73. there is an Account that *S. Montaniri* found two Stars of the ſecond Magnitude wanting in the *Navis*, in the Year 1668. *April* 10. which were certainly viſible before. And that he had made many ſuch Obſervations of Stars of leſs Note.

Caſſini hath diſcover'd alſo many new Stars: One of the fourth, and two of the fifth Light, in *Caſſiopæia*; two others in *Eridanus*; and four towards the *Arctick* Pole, which he is ſure were not viſible formerly. He takes Notice alſo of ſeveral in *Bayer*'s Catalogue, which do now diſappear. *Hevelius*, in 1666, found a new Star *in Pectore Cygni*. And *Don Anthelme*, a Carthuſian at *Dyon*, another in the Head of that Conſtellation. And this both he and Mr. *Caſſini* obſerv'd to be twice in great Splendor, and as often diminiſhing.

Bullialdus obſerv'd the new Star in the Neck of the *Whale*, to be very different in his Magnitudes at different Times. And *Hevelius* obſerves the ſame Thing of another Star in the ſame Conſtellation.

From all which Obſervations, and many others which might be produc'd; 'tis plain, there are very great Changes and Alterations amongſt even the *fixed Stars* themſelves.

And if that noble Conjecture of our modern Aſtronomers be true, that each fixed Star is a Sun to ſome Syſtem of Planets moving round him, as we do round the Sun, there muſt needs be terrible Changes in thoſe Planetary Worlds; and thoſe probably both Conflagrations and Deluges. Of this, ſee more in *Whiſtons*'s *Aſtronomy*, p. 46.

Dr. *Hook*, *Op. Poſthum.* p. 109. gives very probable Reaſons why the *fixed Stars* ſhould be of the ſame Nature with the Sun; which are drawn from their vaſt Diſtance, and their affecting our Eyes with ſo ſtrong and vivid a Light; which they could not do, if they were not actually blazing Fires: And that they are ſo, the Diſappearance of ſome Stars, which have formerly been viſible, and the Appearance of new ones, doth much confirm.

And the incomparable Sir *Iſ. Newton*, in the *Latin* Edition of his Opticks by Mr. *Clark*, hath, to *p.* 83. added this Note; by which we may conclude the *fixed Stars* to be at an immenſe Diſtance from us.

“ That the fixed Stars, by reaſon of their im-
“ menſe Diſtance, are to be looked upon as Points,
“ (unleſs ſo far as their Light is dilated by Refra-
“ ction) is plain from hence: That when by the
“ Moon's Appulſes to them they are eclipſed or
“ cover'd by her Body, their Light doth not, like
“ that of the Planets in the like Caſe, vaniſh or
“ diſappear gradually, but at once and all toge-
“ ther; and when they emerge again out of the
“ Eclipſe, they don't become viſible by degrees,
“ but as it were inſtantaneouſly, or at leaſt in the
“ Space of one or two Seconds.

Beſides what hath been ſaid in the former *Vol.* and above, Dr. *Cheyne* adds this further Gueſs at the Immenſity of the Diſtance of the fixed Stars.

Tho' we on this Globe approach nearer to ſome of them about 24000 Diameters of the Earth, *i. e.* about 188304000 Miles (of 5000 Feet in a Mile) at one time of the Year than we do at another; yet their Parallax, if any at all, is ſcarcely then ſenſible, which it muſt be, if they were at an eſtimable Diſtance from us.

Mr. *Huygens* computes, that the Diſtance of the Sun, to that of the neareſt fixed Star, is as 1 to 27664. that is, (allowing the Diſtance of the Sun to be 12000 Diameters of the Earth, and a Diameter to be 7846 Miles, according to the beſt Calculations) the Diſtance of the neareſt fixed Star from us, is at leaſt 2404520928000 Miles; which is ſo great, that if a Cannon Ball (going all the Way with the ſame Velocity it hath when it parts from the Mouth of the Gun) would ſcarce arrive there in 700000 Years.

In *Philoſ. Tranſ. N.* 202. there is a Method of finding the Parallax of the *fixed Stars*, which Dr. *Wallis* acquaints Mr. *Molyneux* with; but both thoſe Perſons are ſince dead.

FIXED *Stars*, are ſuch as do not, like the Planets or *erratick Stars*, change their Poſitions or Diſtances in reſpect of one another.

Becauſe theſe *fixed Stars* have no ſenſible Parallax ariſing from the annual Motion of the Earth, they are juſtly eſteemed to be at ſuch an immenſe Diſtance, as to have no ſenſible Effect on our Earth.

The Honourable Mr. *Roberts* hath a pretty Diſcourſe about the Diſtance of the *fixed Stars*, which is publiſhed in *Philoſ. Tranſ. N.* 209. The Subſtance of which is as follows.

Since the *Pythagorean Syſtem* of the World has been revived by *Copernicus*, (and now by all *Mathematicians* accepted for the *true one)* there ſeemed ground to imagine, that the Diameter of the Earth's annual Courſe (which according to our beſt Aſtronomers, is at leaſt 40000 Times bigger than our Earth's) might give a ſenſible Parallax to the *fixed Stars*, though the other could not, and thereby determine their Diſtance more preciſely.

But though we have a Foundation to build on, ſo vaſtly exceeding that of the Ancients, there are ſome Conſiderations may make us ſuſpect, that even this is not large enough for our Purpoſe.

Mr. *Huygens* (who was very exact in his Aſtronomical Obſervations) tells us, he could never diſcover any viſible Magnitude in the *fixed Stars*, tho' he uſed Glaſſes which magnify the apparent Diameter above a hundred Times.

Now, ſince in all likelihood the *fixed Stars* are Suns, (perhaps of a different Magnitude) we may, as a reaſonable *Medium*, preſume they are generally about the Bigneſs of our Sun.

Let us then (for Example) ſuppoſe the *Dog-ſtar* to be ſo.

The Diſtance from us to the Sun being about a hundred Times the Sun's Diameter, it is evident, that the Angle under which the *Dog-ſtar* is ſeen in Mr. *Huygen's* Teleſcope muſt be near the ſame with the Angle of its Parallax to the Sun's diſtance, or Semidiameter of the Earth's annual Courſe; ſo that the Parallax to the whole Diameter can be but double ſuch a Quantity, as even to Mr. *Huygen's* nice Obſervation, is altogether inſenſible.

The diſtance therefore of the Stars ſeems hardly within the reach of any of our Methods to determine; but from what has been laid down, we may draw ſome Concluſions that will much illuſtrate the prodigious vaſtneſs of it.

1. That the Diameter of the Earth's annual Orb (which contains at leaſt 160 Millions of Miles) is but as a Point in compariſon of it; at leaſt it muſt be above 6000 times the diſtance of the Sun: For if a Star ſhould appear through the aforeſaid Teleſcope half a Minute broad (which is a pretty ſenſible Maguitude) the true apparent Diameter would not exceed 18 third Minutes, which is leſs than the 6000 Part of the apparent Diameter of the Sun, and conſequently the Sun's diſtance not the 6000 Part of the diſtance of the Stars.

2. That could we advance towards the Stars 99 Parts of the whole Diſtance, and have only $\frac{1}{100}$ Part remaining, the Stars would appear little bigger to us than they do here; for they would ſhew no otherwiſe then they do through a Teleſcope, which magnifies an hundred-fold.

3. That at leaſt nine Parts in ten of the Space between us and the *Fixed Stars*, can receive no greater Light from the Sun, or any of the Stars, than what we have from the Stars in a clear Night.

4. That Light takes up more time in travelling from the Stars to us, than we in making a *Weſt-India* Voyage (which is ordinarily performed in ſix Weeks:) That a Sound would not arrive to us from thence in 50000 Years, nor a Cannon Bullet in a much longer Time. This is eaſily computed by allowing (according to Sir *Iſaac Newton)* ten Minutes for the Journey of Light from the Sun hither; and that a Sound moves about 1300 Feet in a Second. But Sir *Iſaac Newton* doth not allow above 968 Feet for the Motion of Sound in a Second of Time: And the *Florentine* Academicks make it about 1000 Feet.

Our Learned and Accurate Mr. *Flamſtead* ſaith, he hath diſcovered a ſenſible Parallax of the Earth's annual Orbit in reſpect of the *fixed Stars*; of which he publiſhed an Account in a Letter to Dr. *Wallis*, in the Year 1698, which is Printed in the Third Volume of *Wallis*'s Mathematical Works in *Latin.*

FIXITY, or *Fixtneſs*, is the oppoſite Quality to *Volatility*; and the Excellent Mr. *Boyle* reckons theſe Qualifications following to be the moſt conducing for the rendring of a Portion of Matter fixt.

1. That its Corpuſcles be ſingly of a proportionate large Bulk or Groſſneſs, ſo as to be too big and unweildy to be carried up by Heat, or to be buoyed up in the Air.

2. That theſe Corpuſcles have alſo a proportional Degree of Ponderouſneſs or Solidity.

3. That their Figure and Make alſo be ſuch as renders them unfit for Avolation, either from their Shape, being branched, crooked, hooked, *&c.* ſo that they be entangled one with another, and cannot eaſily be extricated, looſened, or ſeparated: And therefore whatever will produce theſe three Requiſites in any Body, will render it of a fixt Nature.

4. To theſe may be added alſo the bringing the Corpuſcles or Particles of any Body to touch one another in a conſiderably larger Part of their Surface.

FIXITY. To the Production of this Property of Fixity, there is neceſſary chiefly a Suppoſition of the Particles *attracting* one another, within a certain Diſtance, with a very violent Force; or elſe they could never keep together, when preſs'd by a violent Heat; which yet we find the Particles of ſome fixed Bodies will do. See *Coheſion.*

FIXT *Nitre*, is Salt-petre melted in a Crucible, and then made to flame, by throwing in a Spoonful of Powder of Coals; and this is repeated till no Flame nor Detonation ariſe: After this 'tis cooled, powdered, and diſſolved in Water, and then evaporated into a fine white Salt. 'Tis a Salt much like that of Tartar, and is uſed, like it, to help to draw Tinctures out of Vegetables. Some Chymiſts give it the Name of *Alkaheſt*, becauſe 'tis, as they ſay, a kind of Univerſal Diſſolvent. If this Salt be expoſed to the Air in a cool Place, it will all diſſolve into a Water, or, as they ſay, run *per Deliquium*; and this is called, *The Liquor of fixt Nitre.*

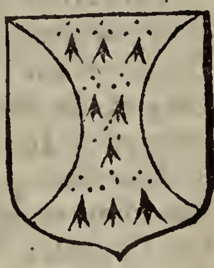
FLAGS, on Board a Ship, are Colours, Ancients, or Standards, which the Admirals of a Fleet bear on their Tops. The Admiral in Chief carries his on his *Main-Top*, the Vice-Admiral his at the *Fore-Top*, and the Rere-Admiral his at his *Miſſen-Top*.

FLAIR: The Seamen ſay that the Work *flairs over*, when a Ship being houſed in, near the Water, a little above that the Work hangs over a little too much, and ſo is let out broader aloft than the due Proportion will allow.

FLAMMA *Vitalis*: Some ſuppoſe that there reſides in the Heart of Animals ſuch a fine and kindled, but mild Subſtance, as they call a *Vital Flame*; and to its Preſervation they judge the Air taken in by Reſpiration to be neceſſary, as it is to the Conſervation of ordinary Flame. *L.*

The Excellent Mr. *Boyle*, by ſeveral Experiments purpoſely made in his exhauſted Receiver, about the Relation between Flame and Air, found that the Vital Flame of Animals (if the Life may be ſo called) did ſurvive or outlaſt the Flame of Spirit of Wine, or of a Wax or Tallow Candle; ſince the Animals would remain alive and well for three or four Minutes after the Receiver was evacuated, whereas no common Flame would laſt there one Minute.

The Light of Glow-worms that Noble Gentleman found alſo would preſently be deſtroyed by the exhauſting Motion of the Air, by his Engine, as it would be re-produced again by its Admiſſion into the Receiver.



FLANCH, an Ordinary in *Heraldry*, formed by an Arch-line, which begins at the Corners of the *Chief*, and ends in the *Baſe* of the Eſcutcheon thus.

He beareth *Ermin*, two *Flanches Vert.*

Flanches are always born by Pairs. The *Flanch* bends in more than the Flaſk.

FLANK, [in *Fortification*,] is that Part of the Baſtion which reaches from the Curtain to the Face, and defends the oppoſite Face, the Flank, and the Curtain.

There is alſo the Oblique or Second Flank, which is that Part of the Curtain where they can ſee to ſcour the Face of the oppoſite Baſtion; and is the Diſtance between the Lines *Razant* and *Fitchant*.

The *Low*, *Covered*, or *Retired Flank*, is the Platform of the Caſemate, which lies hid in the Baſtion.

The Flanks of a Battalion or an Army, are its Sides.

They uſe alſo the Word *to flank* an Army; that is, to diſcover and fire upon its Sides.

Any Fortification which hath no Defence right forwards, is on that account faulty and defective; and to render it compleat, one Part muſt be made *to flank* another. The Curtain therefore is the ſtrongeſt Part of any fortified Place, becauſe it is *flanked* by the two Flanks at its Ends.

FLANK, is alſo a Term of War, ſignifying one Side of a Battalion of an Army; as to attack the Enemy in Flank, is to diſcover and fire upon them on one Side.

FLANK *of the Curtain*, or *Second Flank*, is that Part of the Curtain between the Flank and the Point, where the *Fitchant Line of Defence* terminates.

To FLANK, in general, is to diſcover and fire upon the Side of any Place; but to

FLANK *a Place*, is to diſpoſe a Baſtion, or other like Work, in ſuch a manner, that there ſhall be no Part of it but what is defended; ſo as you may from thence play upon Front and Rear: For any Fortification that hath no Defence, but juſt right forwards, is faulty; and to render it compleat, one Part ought to be made to flank the other: Hence the Curtain is always the ſtrongeſt Part of any Place, becauſe 'tis flanked at each End.

Fitchant FLANK, is that from whence a Cannon playing, fireth its Bullets directly in the Face of the oppoſite Baſtion.

FLANK *Razant*, is the Point from whence the Line of Defence begins, from the Conjunction of which with the Curtain, the Shot only razeth the Face of the next Baſtion, which happens when the Face cannot be diſcovered but from the Flank alone.

Retired FLANK, or the *Lower* or *Covert Flank*, is that exterior Part thereof which advanceth to ſecure the innermoſt; which advanced Part, if it be rounded, is called the *Orillon*; ſo that this *Flank Retire*, as the *French* call it, is only the Platform of the *Caſemate*, which lies hid in the Baſtion.

Simple FLANKS, are Lines which go from the *Angle of the Shoulder* to the *Curtain*, and whoſe principal Function is the Defence of the Moat and Place.

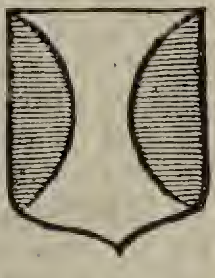
FLANK'D, or *Double Tenaille*: See *Tenaille.*

FLANK'D *Angle*, is the Angle formed by the two Faces of the Baſtion, and ſo forms the Point of the Baſtion.

FLANKING *Line of Defence*: See *Raſant Line of Defence.*

FLANKING *Angle*: See *Angle.*

FLASK, is in *Heraldry*, an Ordinary made by one Arch-line drawn downwards to the Baſe Point: It ſeems to be the Repreſentation of a Bow, when bended; and they are always born double, thus:



The Field is *Or*, two *Flasks Azure.*

Some Heralds ſay, the *Flask* is a Reward for a Man of Virtue and Learning, who hath deſerved well of his Prince in an Embaſſy.

FLAT: To *flat* a Ship is to hale in the Fore-ſail by the Sheet, as near to the Ship's Sides as may be, which is called, *Flatting in the Fore-ſail.* This is done when a Ship will not fall off from a Wind without it, though the Fore-ſheet was haled aft.

FLAT *Baſtion*: See *Baſtion.*

FLAT *Bottom'd Moat*: See *Moat.*

FLAT *Crown*: See *Corona.*

FLAT-*Pointed Nails*, are of two Sorts; the *longer* are uſed in Shipping, and are very proper to hold where you cannot clench; the *ſhorter* are fortified with Points to drive into Oak, and are uſed to draw Sheathing-Boards to, &c.

FLATS, [in *Muſick*,] a kind of conditional Notes, contriv'd together with *Sharps*, to remedy the Defects of muſical Inſtruments.

FLATULENT, [*Flatulentus*, L.] of or pertaining to *Flatus's* or Winds.

FLATUS, are Effervefcencies excited in the Body from Wind let in, or from flatulent Meats, or from the Bile and Pancreatick Juice mixed together, whence Wind and Noiſe. *L.*

FLAW, at Sea, ſignifies a ſudden Guſt of Wind, which ſometimes alſo the Seamen call a *Squale.*

FLEDWIT, a Term in Law, ſignifying a Diſcharge or Freedom from Amerciaments, where one having been an Outlaw'd Fugitive, cometh to the Peace of our Lord of his own accord.

FLEMESWITE, [in *Law*,] ſignifies the Liberty to challenge the Cattle, or Amerciaments of your Man, a Fugitive.

FLESH, of an Animal Body, is by Anatomiſts defined to be a ſimilar and fibrous Part, ſoft and thick: Of this they reckon five Kinds.

1. Muſculous, fibrous, or fiſtular Fleſh, ſuch as is the Subſtance of the Heart, and other Muſcles.

2. *Parenchymous* Fleſh, as that of the Lungs, Liver, and Spleen, was thought to be by the Ancients; but ſince the Uſe of Glaſſes 'tis plainly diſcovered that there is no ſuch thing as a *Perenchyma*, properly ſpeaking; but that all the *Viſcera*, as well as other Parts of the Body, are *Vaſcular*, and nothing but *Plexus*, or Net-work of ſmall Veſſels and Canals.

3. *Viſcerous*, ſuch as the Fleſh of the Stomach and Guts.

4. *Glandulous*, as that of the *Tonſils*, the *Pancreas*, the Breaſts, &c.

5. *Spurious*, ſo they call the Fleſh of the Lips, Gums, the *Glans* of the *Penis*, &c. becauſe 'tis of a Conſtitution different from all the reſt.

FLESH, [in *Botany*,] the ſoft pulpy Subſtance of any Fruit, incloſ'd between the outer Rind or Skin, and the Stone; or it is that part of a Root, Fruit, &c. fit to be eaten.

FLEXIBLE [in *Phyſicks*,] is an Epithet apply'd to Bodies which are capable of being bent or changed from their natural Form of Directions.

FLEXION, [by *Anatomiſts*,] is a Term us'd of the Motion of an Arm, or other Member, when bent.

FLEXION and *Retrogreſſion of Curves*. See *Contrary Flexion*.

FLEXOR *Carpi Radialis*, is a Muſcle of the Wriſt, which ariſeth Tendinous from the internal Extuberance of the *Os Humeri*, becoming fleſhy, adheres ſtrictly to the *Pronator Radii Teres*, and in half its oblique Progreſs to the *Carpus* it becomes a flat Tendon, which paſſeth over the annular Ligament, and is inſerted to the upper Part of the *Os Metacarpi*, which ſuſtains the fore-finger: Its Name ſhews its Uſe. *L.*

FLEXOR *Carpi Ulnaris*, is a Muſcle of the Wriſt, which ariſes tendinous from the ſame Tubercle of the Shoulder-bone, with the *Flexor Radialis*; as alſo from the ſuperior and external Part of the *Ulna*, where the *Muſculus Perforans* doth ariſe; and continuing fleſhy according to the length of the *Ulna*, is partly inſerted by a ſhort ſtrong Tendon into the fourth Bone of the *Carpus*, and partly into the *Os Metacarpi*, which ſuſtains the Little-finger. Its Name declares its Uſe. *L.*

FLEXOR *Secundi Internodii Digitorum Pedis*: See *Perforatus Pedis*. L.

FLEXOR *Tertii Internodii Digitorum Pedis*: See *Perforans*. L.

FLEXOR *Tertii Internodii*, or *Longiſſimus Pollicis*, is a Muſcle of the Thumb, which is obſerved to have a twofold Beginning. *L.*

The firſt and ſuperior of which ariſeth acutely from the internal Extuberance of the *Os Humeri*, between the *Perforatus* and *Perforans*, becoming a fleſhy Belly, and then tendinous, joins with the middle Tendon of its other larger Head.

The ſecond or inferior Origin of this Muſcle (is that Part of it which is commonly deſcribed) ariſing with a double Order of fleſhy Fibres for ſome Space on the *Radius*, from immediately below its ſuperior Part; which uniting in a middle Line or Tendon, (not unlike the *Fibrillæ* of a Feather, joining to their *Stamina*) which paſſing over the Articulation of the *Carpus*, becomes entirely tendinous, as it runs over the *Flexor primi & ſecundi Internodii*, to its Implantation at the ſuperior Part of the third Bone of the Thumb.

FLEXOR *Pollicis Brevis*, is a Muſcle of the great Toe, which ariſeth from the ſuperior Part of the *Os Cuneiforme Medium*, and running over the Termination of the *Muſculus Peroneus*, is implanted into the *Oſſa Seſamoidea* of the great Toe, who are likewiſe tied to the ſuperior Part of the ſecond Bone of the ſaid Toe which bends it. *L.*

FLEXOR *Pollicis Pedis Longus*, is a Muſcle of the great Toe, which is a direct Antagoniſt to the *Extenſor Longus*: It ariſes oppoſite to it from the Back-part of the *Fibula*, with a double Order of fleſhy Fibres, running to a middle Tendon (like the *Flexor tertii internodii Pollicis Manus*) which ceaſeth to be fleſhy as it paſſes over the Juncture, and runs through a Channel on the internal Part of the *Os Calcis*, under the Tendon of the *Muſculus Flexor Digitorum Longus Perforans*, over the *Flexor Pollicis Brevis*, and is inſerted to the upper End of the ſecond Bone of the great Toe: Its Uſe is to bend the Toe. *L.*

FLEXOR *primi & ſecundi Oſſis Pollicis*, is a large diſgregated fleſhy Muſcle, ariſing from the *Ligamentum Tranſverſale Carpi*, Bones of the *Carpus*, at the Baſis of the *Mons Lunæ*, and *Os Metacarpi* of the Middle Finger, whence it paſſes to its Inſertion partly to the *Oſſa Seſamoidea* of the ſecond Internode, and partly to the firſt Bone of the Thumb: This (as *Veſalius* writes) may be divided into Three. Its Actions are various, according to the Diverſity of its *Series* of Fibres; ſo it bends the firſt or ſecond Bones of the Thumb, either directly or obliquely towards the *Carpus* and *Vola Manus*. L.

FLIE, that Part of the Mariner's Compaſs on which the 32 Winds are drawn, and to which the Needle is faſtned underneath, they call the *Flie*.

FLIGHT. In melting the Lead-Oar in the Works in *Mendip*, there is a Subſtance flies away in the Smoak, which they call therefore the *Flight*. They find it ſweetiſh upon their Lips, if their Faces happen to be in the way of the Smoak; which they avoid all they can. This falling on the Graſs, kills Cattle that feed there; and being gather'd and carried Home, kills Rats and Mice in their Houſes. That which falls on the Sand, they gather and melt (upon a *Flag-hearth*) into Shot and Sheet-Lead.

FLOATING-*Bridge*, is a Bridge made in form of a Redoubt, conſiſting of two Boats covered with Planks, which ought to be ſo ſolidly framed, as to bear both Horſe and Cannon.

FLOND, or *figurative Deſcant*, a Term in Muſick. See *Deſcant*.

FLOOR, [in *Architecture*,] the underſide of a Room, or that Part whereon Perſons walk; as well the framed Work of Timber, or the Boarding over it.

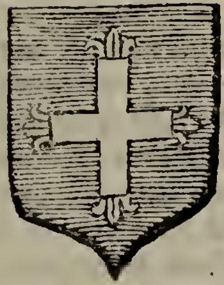
FLOOR, in a Ship, ſtrictly taken, is ſo much only of her Bottom as ſhe doth reſt upon when ſhe lieth on Ground; and therefore thoſe Ships that have long, and withal broad Floors, lie on the Ground with moſt Security, and are not apt to *Seel*, (that is, to fall on the one Side;) whereas the other which are *Crank by the Ground*, (as the

Sea Phraſe is) that is narrow in the Floor, cannot be grounded without Peril either of being overthrown, or, at leaſt, of wronging her Sides. And note, the Word *Overthrown* is uſed when a Ship is brought to be *trimmed a-ground*, and ſo by ſome Miſchance doth fall over on her Side; but when a Ship at Sea is turned over on the one Side, ſhe is ſaid to be *Over-ſet*.

FLORENS, were Gold Coins in the 18th of our *Edw.* III. of the Value of 6 Shillings. *Camden* ſaith, they were ſo called, becauſe made by *Florentines:* And *Fabian* ſaith, they were not of ſo fine Gold as the Nobles and half Nobles of that Prince.

But what is moſt obſervable is, that *Fabian* calls the *Floren* a Penny, val. 6*s.* 8*d.* the half *Floren* an Halfpenny, val. 3*s.* 4*d.* the Quarter *Floren* a Farthing, val. 1*s.* 8*d.* And theſe Words you will often meet with in old Hiſtories and Accounts, applied to ſeveral Coins, as Rials and Angels, *&c.* where you are to underſtand, by *Denarius* the whole, by *Obolus* the half, and by *Quadrans* the fourth Part or Farthing. *Chr. Precioſum*, p. 22.

By Indenture of the Mint, in 18 *Edw.* III. every Pound Weight of old Standard Gold was to be coined into 50 *Florences*, to be current at 6 Shillings a-piece; all which made, in Tale, fifteen Pounds: Or into a proportionable Number of half or quarter *Florences*. *Cowel's Interpreter.*



FLORY, a Term in *Heraldry*, when the Out-lines of any Ordinary are drawn, as if trimm'd with, or in the Form of Flowers.

Thus this Croſs they call a *Croſs-Flory*.

FLOTSON, or *Flotzam*, is a Word proper to the Sea, ſignifying any Goods loſt by Shipwreck, and floating and ſwimming upon the Top of the Water; which, with *Jetſon*, and *Lagon*, and others, are given to the Lord Admiral by his Letters Patent.

Jetſon, is a Thing caſt out of the Ship, being in Danger of Wreck, and beaten to the Shore by the Waters, or caſt on the Shore by the Mariners.

Lagon, or *Lagan*, or *Ligan*, is that which lieth in the Bottom of the Sea.

Shares, are Goods due to more by Proportion.

FLOWER *of a Plant:* According to Dr. *Grew*, the Flowers of Plants have commonly theſe three Parts;

The *Empalement*, the *Foliation*, and the *Attire:* Which Words ſee.

And Mr. *Ray* reckons, that every perfect Flower muſt have the *Petala*, the *Stamina*, the *Apices*, and the *Stylus:* Wherefore whatever Flower wants any of theſe, is to be look'd upon as in that reſpect imperfect.

In moſt Plants there is a *Perianthium*, *Calix*, or Flower-Cup, of a ſtronger Conſiſtence than the Flower it ſelf, and deſign'd to ſtrengthen and preſerve it; it compaſſes the Flower about at the bottom.

Mr. *Ray* divides alſo the perfect Flowers of Plants (now reckoning them perfect if they have the *Petala* without the *Stamina*) into ſimple Flowers, which are not compoſed of other ſmaller ones, and which uſually have but one ſingle Style.

2. *Compounded*, *Aggregated*, or *Compoſite Flowers*, which are ſo compounded of many little *Floſculi*, as that they all make but one Flower.

Simple Flowers are *Monopetalous*, which have the Body of the *Flower* all of one entire Leaf, tho' ſometimes cut or divided a little way into many ſeeming *Petala* or Leaves, as in *Borage*, *Bugloſs*, &c. Or,

Polypetalous, which have diſtinct *Petala*, and thoſe falling off ſingly, and not altogether, as the ſeeming *Petala* of the *Monopetalous Flowers* always do.

And both theſe he divides into

$$\left.\begin{array}{c}\textit{Uniform}\\ \text{and}\\ \textit{Difform}\end{array}\right\}\text{Flowers.}$$

The former have the right and left Hand Parts, and the forward and backward Parts of the Flower all alike.

But thoſe he accounts to have a difform Flower, which have no ſuch Regularity; as in the Flowers of *Sage*, *Dead-nettle*, &c.

A *Monopetalous Difform Flower* alſo, he divides into,

1. *Semifiſtular*, i. e. ſuch whoſe upper Part reſembles a Pipe cut off obliquely, as in the *Ariſtolochia*.

2. *Labiate*, and this either with one Lip only, as in the *Acanthum* and *Scordium*; or with two Lips, as in the far greateſt Part of the labiate Flowers. And here the upper Lip of the Flower ſometimes is turned upwards, and ſo turns the convex Part downwards, as in the *Chamæciſſus*, &c. But moſt uſually the upper Lip is convex above, and turns the hollow Part down to its fellow below, and ſo repreſents a kind of *Helmet* or *Monk's Hood.* And from hence theſe are frequently called *Galeate*, *Cucullate*, and *Galericulate* Flowers, as you will find in Books of Botany: And in this form are the Flowers of the *Lamium*, and moſt *Verticillate* Plants. Sometimes alſo the *Labium* is entire, and ſometimes jagged or divided.

3. *Corniculate*, i. e. ſuch hollow Flowers as have on their upper Part a kind of *Spur*, or *little Horn*; as in the *Linaria*, *Delphinium*, &c. And the *Corniculum* or *Calcar* is always impervious at the Tip or Point.

Compounded Flowers are either,

1. *Diſcous*, or *Diſcoidal*, that is, whoſe little *Floſculi* are ſet together ſo cloſe, thick, and even, as to make the Surface of the Flower plain and flat; which therefore, becauſe of its round form, will be like a *Diſcus:* Which Disk is ſometimes radiated, when there are a Row of *Petala* ſtanding round in the Disk like the Points of a Star, as in the *Matricaria*, *Chamæmelum*, &c.

Sometimes *Naked*, i. e. having no ſuch radiating Leaves round the Limb of its Disk; as in the *Tanacetum*.

2. *Planifolious*, which is compoſed of plain Flowers ſet together in circular Rows round the Center, and whoſe Face is uſually indented, notched, uneven, and jagged; as the *Hieracia*, *Sonchi*, &c.

3. *Fiſtular*, which is compounded of many long, hollow, little Flowers like Pipes, all divided into large Jaggs at the Ends.

Imperfect Flowers, becauſe they want the *Petala*, are called *Stamineous*, *Apetalous*, and *Capillaceous*.

And thoſe which hang pendulous by fine Threads like the *Juli*, are by *Tournefort* called *Amentaceous*; we call them Cats-Tails.

The ſame Writer uſes alſo the Term *Campaniformis* for ſuch Flowers as are in the Shape of a Bell; and *Infundibuliformis* for ſuch as are in the form of a Tunnel.

He diſtinguiſhes alſo ſome difform monopetalous Flowers by the Name of *Perſonati*; by which he means ſuch as expreſs the gaping Mouths of ſome Animals; and diſtinguiſhes *theſe* from what he calls *Labiati*, in that the *Stylus* or *Piſtillum* of theſe doth not end in a *Capſula Seminalis*, as it doth in *thoſe*.

FLOWER-DE-LIS, the Mark of Difference in *Heraldry* for the ſixth Brother of any Family: 'Tis alſo often born as Coat Armour.

FLOWER *of Sulphur*, or *Brimſtone*, is made by putting the Sulphur groſly powdered into a Glaſs Body placed on a ſmall open Fire, and having put over, or into its Neck, another Veſſel of Earth of the ſame form, but unglazed, the Fire will ſublime the Flowers, and make them adhere to the upper Veſſel, which muſt be changed every half Hour.

FLOWERS [in *Chymiſtry*,] are the fineſt and moſt ſubtil Parts of dry Bodies, rais'd by Fire into the Head and *Aludels*, and adhering to them in form of a fine Powder or Duſt; as Flowers of *Benjamin*, *Sulphur*, &c. See *Aludels*.

FLOWN-SHEETS. The Seamen ſay a Ship ſails with *Flown-Sheets*, when her Sheets are not *haled home*, or cloſe to the Blocks: They ſay alſo, *Let fly the Sheet!* When in a great Guſt of Wind, for fear the Ship ſhould over-ſet, or ſpend her Top-maſts, they would have the Sheet *go a-main*, or as far as it will run, becauſe then the Sail will hold no Wind; and when the Sheets are thus let go, they ſay, *Her Sheets are Flown*.

FLUID *Body*: The excellent Sir *Iſ. Newton* defines a *fluid Body* to be that whoſe Parts eaſily give Place, and move out of the way on any force impelled upon them, and by that means do ſo very eaſily move over one another; which is a much better Definition than that of *Des Cartes*, That a Fluid is a Body whoſe Parts are in continual Motion; becauſe 'tis neither apparent that the Parts of all Fluids are ſo; nor that the Parts of ſome ſolid Bodies are not ſo.

FLUIDITY [*fluiditas*, *L.*] ſeems to conſiſt in this: That Parts of any Bodies being very fine and ſmall, are ſo diſpoſed by Motion and Figure, as that they can eaſily ſlide over one another's Surfaces all manner of ways: It ſeems requiſite alſo, as Mr. *Boyle* obſerves, That they ſhould be variouſly and ſeparately agitated to and fro, and that they ſhould touch one another but in ſome Parts only of their Surfaces. And that Excellent Gentleman, in his Hiſtory of Fluidity, intimates, That the Conditions requiſite to conſtitute a fluid Body are chiefly theſe three:

1. The *Littleneſs of its Parts*. Thus we ſee the Fire, by dividing Metal into Parts very fine and ſmall, will melt them, and make them fluid. And acid Menſtruums after the ſame manner diſſolve them and ſuſpend them in Liquor; and Fire will turn the hard Body of common Salt almoſt all of it into a Liquor, by Diſtillation; though 'tis not improbable, that the Shape and Figure of theſe ſmall Parts may conduce much towards producing this Quality of Fluidity: For we find in the Diſtillation of Oil Olive, (which is a Fluid made only by Preſſure) that moſt of the Oil will by the Action of the Parts of the Fire, (note, it muſt be done in a Retort) be turned into a kind of conſiſtent Subſtance like Butter.

2. It ſeems requiſite to Fluidity, that there be ſtore of vacant Places interſperſed between the Corpuſcles of the fluid Body; for elſe there will not be room for each Particle to continue its Motion and Agitation on the Surfaces of the neighbouring ones. For,

3. The chief Condition requiſite to conſtitute a fluid Body, is, That its Particles be agitated variouſly, and apart, either by their own proper Motion, or by ſomething of Subſtance which tumbles them up and down by its Paſſage through them That this Qualification chiefly is requiſite to Fluidity, you may gather from that common Experiment of putting Powder of Alabaſter, or of common Plaiſter of *Paris*, finely ſifted in a flat bottom'd Veſſel over the Fire; for in a little time the dry Powder will boil like Water, and imitate all the Motions of a boiling Liquor; it will tumble variouſly over in great Waves like that, it will bear ſtirring with a Stick or Ladle like that, without reſiſting, as it will do when cold; nay, if you ſtir it ſtrongly near the Side of the Veſſel, its Waves will apparently daſh up againſt the Sides; but yet if you take any of it out, and lay it ſpeedily on a Piece of white Paper, you will ſee 'tis nothing but a dry Powder.

So that from hence 'tis plain, there is a real Difference between a fluid Body and a wetting Liquor; for not only this boiling Powder, and melted Metals, but the Air, *Æther*, and even Flame it ſelf, are properly fluid Bodies, though not moiſt Liquors.

This noble Gentleman found alſo, That by blowing the Smoak of Roſemary into a Glaſs Pipe, and then holding the Pipe (when filled) upright, the Surface of the Smoak would accomodate its ſelf to a level Situation; and which way ſoever you inclined the Tube, the Superficies of the Smoak would lie parallel to the Horizon; and when the Glaſs was much inclined, would run along it like Water.

Whence he infers, That in order to the rendring a Body fluid, there is no need that its Parts ſhould be ſo cloſely condenſed as thoſe of Water are.

Dr. *Hooke*, in his *Micrograph. p.* 12. hath a pretty Experiment or two to prove this Account of Fluidity, *viz.* that of a Diſh of Sand ſet on a Drum-head briſkly beaten by the Sticks, or on the upper Stone of a Mill, turning ſwiftly round on the (empty) lower one; it will in almoſt all Reſpects emulate the Properties of a fluid Body. For a heavy Body will immediately ſink in it to the Bottom, and a light one emerge to the Top; each Grain of Sand hath a conſtant vibrating and dancing Motion; and if a Hole be made in the Side of the Diſh, the Sand will ſpin out like Water.

FLUIDITY. Beſides what hath been ſaid of this Quality, I muſt add here, That the Corpuſcular Philoſophy, before Sir *Iſ. Newton*'s wonderful Improvement of it, did not go to the bottom of this Matter; for it gave no Account of the Cauſe of the chief Condition requiſite to conſtitute a fluid Body, *viz. the various Motions and Agitations of its Particles*. But this may be in a good Meaſure accounted for, if you ſuppoſe it to be one of the primary Laws of Nature, that as all Particles of Matter do attract one another when they come within a certain Diſtance, ſo, at all greater Diſtances from one another, they do fly away from, and avoid one another. For then, though their common Gravity may keep them together in a Maſs, (it may be ſometimes) with the Preſſure of other Bodies upon them; yet their continual Endeavour to avoid one another ſingly, and the adventitious Impulſes of Light, Heat, or other external Cauſes, may make the Particles of Fluids continually move round about one another, and ſo produce this Quality. It is indeed, a Difficulty I cannot yet get over, to account for the Particles of Fluids always keeping at ſuch a Diſtance from one another, as not to come within the Sphere of one anothers Attraction. The Fabrick and Conſtitution of that fluid Body of Water is wonderful and amazing, that a Body ſo very rare as that is, and which has ſuch a vaſt Over-proportion of Pores, or interſperſed Vacuity, to ſolid Matter, ſhould yet be perfectly incompreſſible by the greateſt Force. And yet this Fluid is eaſily reducible into that firm, tranſparent, friable Body, which we call Ice; by being only expoſed to a certain Degree of Cold. One would think here, that though the Particles of Water cannot come near enough to attract each other, yet the intervening frigorifick Matter doth, by being mingled *per minima* with them, ſtrongly attract them, and is it ſelf alſo ſtrongly attracted by them, and ſo wedges or fixes all the Maſs into a firm ſolid Body: Which ſolid Body, loſes its Solidity again, when by Heat the Vinculum is ſolv'd, and theſe frigorifick Particles are disjoin'd from thoſe of the Water, and are forc'd to fly out of it. And perhaps juſt thus doth the Fumes of Lead fix Quickſilver.

When a firm ſolid Body, ſuch as a Metal, is by Heat reduc'd into a Fluid, doth not the Fire diſjoin and ſeparate its conſtituent Particles, which mutual attraction cauſed to cohere before, and keep them at ſuch a diſtance from each other, as that they are without the Sphere of one another's Attraction as long as that violent Motion laſts? And don't they, when that is over, and the Heat is flown out, come nearer to, attract one another, and coaleſce again?

As therefore the Cauſe of Coheſion of the Parts of ſolid Bodies appears plainly to be their mutual Attraction; ſo the chief Cauſe of Fluidity ſeems to be a contrary Motion impreſſed on the Particles of Fluids, by which they avoid and fly one another as ſoon as they come at, and as long as they keep at ſuch a Diſtance from each other.

'Tis obſerv'd alſo in all Fluids, that the Direction of their Preſſure againſt the Veſſels that contain them, is in Lines perpendicular to the Sides of ſuch Veſſels; which Property being the neceſſary Reſult of the Particles of any Fluids being ſpherical, it ſhews that the Parts of all Fluids are ſo, or of a Figure very nearly approaching thereunto.

Of the Reſiſtance of FLUIDS.

The Reverend Dr. *Deſaguliers*, did in the Year 1721, make the following Experiment, relating to the Reſiſtance of Fluids, before the Royal Society.

He took a Ball of Gold of an Inch Diameter, which had a little Stem of the ſame Metal, with a Place on it to faſten a String to; and having ſuſpended it by a ſilken Thread, too ſtrong to be lengthened by ſtretching, he made the diſtance between the Centre of the Ball and the Point of Suſpenſion, equal to 12, 5 Inches; then cauſing the Ball to vibrate in a Trough full of Water, (which had an upright Piece of Wood in the middle of one Side, with Pins or Keys from which the Bell hung, that the Centre of Suſpenſion might always be in the ſame Place) he obſerv'd, by looking from a Pin on one Side of the Trough, to a Mark made oppoſite to it on the other Side, whereabouts the String of the Pendulum (juſt above the Surface of the Water, in which the Ball was quite immerſed) went after 14 Vibrations; and by another Pin and oppoſite Mark, he alſo obſerv'd where it went to after 28 Vibrations: Then taking out the Water, he fill'd the Trough with Mercury, the length of the Pendulum, Point of Suſpenſion, and all other Things, remaining as before: Then letting go the Ball in the Mercury from the ſame Place whence it was let down when the Trough was full of Water, (which was mark'd by a String ſtretch'd acroſs to prevent Miſtakes) after one whole Vibration, it came very little ſhort of the ſame Mark as it had come to in Water after fourteen Vibrations; and when it vibrated twice in Mercury, it came to the ſame Place where it had done after between 26 and 28 Vibrations in Water; and this it did exactly ſeveral times.

After that he fill'd an upright Copper Pipe of four Inches Diameter with Mercury, to the height of 3 Feet 10 Inches; and ſuſpending the Golden Ball in it by a ſhort String about an Inch long, ſo as to have the Ball juſt immerſed under the middle of the Mercury, he caus'd it to be let down ſuddenly, and obſerving how long it was falling down to the Bottom of the Tube, he found that the Experiment was diſturb'd by the Ball's ſtriking againſt the Sides of the Tube, which retarded the fall of the Ball, and the more ſo, the oftner the Ball ſtruck. When the Ball was leaſt retarded, it was only two Seconds and a half in falling, which muſt be taken as the true time of the fall of the Ball in an height of Quickſilver equal to 3 Feet 10 Inches; becauſe that he trying the Experiment again at home, the Ball fell in the Mercury once or twice, without ſtriking the Sides of the Tube at all; but not in leſs time than $2\frac{1}{2}$ Seconds.

He alſo repeated the other Experiments at home, making the Golden Pendulum 39, 2 Inches long, ſo as to make it vibrate but once in a Second; and then he found that it would vibrate five or ſix times in the Mercury before the Vibrations became ſo ſmall as not to be obſerv'd; and then the firſt Vibration in the Mercury ended very near where the 14th in Water had done; the ſecond in Mercury ended where the 27th in Water had done; and obſerving the third Vibration in Mercury, it ended exactly at the Mark where the 40th in Water ended; and this was obſerv'd by ſeveral Perſons as well as himſelf.

Then he weighed 14 Penny-weight of Mercury, (in which he made the Experiments) firſt in the Air, then in Water, where it loſt only one Penny-weight, and one Grain of its Weight; that is, it weigh'd in Air 336 Grains, and in Water 311; ſo that its ſpecifick Gravity was to that of Water, as 13, 44 to 1.

As to the Golden Ball, which had Varniſh and Cement upon it, to keep the Mercury from ſinking into it, he found it to weigh as follows.

		Ounc.	dwt.	Gr.
It weigh'd	In Mercury	1	00	18, or 498 Gr.
	In Water	5	01	00, or 2424 Gr.
	In Air	5	07	09, or 2577 Gr.

He took the Wire and Pendulum of a long Pendulum Clock, and having faſtened the Golden Ball at the End of the Wire under the pendulous Weight that ſerv'd for the Clock, in order to make the Vibrations in the Golden Ball in the Mercury continue longer, he did not find it to keep on the Motion above one Swing or two the longer for that Help; neither did a round Ball of Lead, placed upon the ſaid Wire, juſt above the Surface of the Mercury, help any more; and finding ſome Inconveniencies in theſe two laſt Ways of making the Experiment, he rather choſe to rely upon thoſe made with the Golden Ball hanging by a ſilken Thread of 39, 2 Inches long, meaſuring from the Point of Suſpenſion to the Centre of the Ball.

FLUOR, [in *Phyſick*, &c.] a Fluid; or more properly that ſtate of a Body that was before hard or ſolid, but is now reduc'd by Fuſion or Fire into a ſtate of Fluidity.

FLUOR *Albus*, or *Fluor Uterinus*, is a continual Evacuation of corrupt Humours from the Womb, or the Pores in the *Vagina*. L. *Blanchard.*

FLUORES, a Word uſed by the modern Mineral Writers for ſuch ſoft, tranſparent, ſparry kinds of Mineral Concretions, as are frequently found among Oars and Stones in Mines and Quarries.

FLUSH. When the Deck of a Ship is even from Stem to Stern, without any Falls or Riſings, they ſay her Deck lies *Fluſh* fore and aft.

FLUTES, [in *Architecture*,] are the Hollows made in the Body of a Column or Pillar, and which then is ſaid to be *fluted*. The *Dorick*, *Ionick*, *Corinthian*, and *Compoſite* Columns, are uſually fluted all along the Body of the Pillar, from the Baſe to the Capital. Each Column hath 24 *Flutes*, and each *Flute* is hollowed in exactly a quarter of a Circle. In the *Dorick* Column the *Flutes* join together without any Interſpace; but in the *Ionick*, *Corinthian*, and *Compoſite* Orders, there runs a Liſt between every two *Flutes*.

FLUX and *Reflux* of the Sea, [in *Hydrography*,] a regular periodical Motion of the Sea, which happens twice in 24 Hours; wherein the Water is riſen and driven violently againſt the Shore. It is one of the Motions of the Tide, called the *Flow*; the other Motion by which the Water ſinks and retires, is call'd the *Reflux* or *Ebb*.

FLUX-*Powders*, or as the *French* call them, *Fondants*, are Powders prepared to facilitate the Fuſion of the harder Metals, and to melt Oars, in order to diſcover what Proportion of Metal they hold or contain.

Powder of Antimony alone is a very good Flux in many Caſes; and by it you may readily melt Iron or Steel in a Crucible, with an ordinary Charcoal Fire.

Mr. *Boyle* gives an Account of a *Flux-Powder* he uſed, which was compoſed of *Tartar*, *Sulphur*, and *Arſenick*.

FLUXION, the ſame with *Catarrh*.

FLUXIONS, or *Method of Fluxions*, is the Arithmetick or *Analyſis* of infinitely ſmall variable Quantities; or it is the Method of finding an infinite ſmall, or infinitely ſmall Quantity; which being taken an infinite Number of times, becomes equal to a Quantity given.

FLUXIONS. This general Method of finding the *Fluxions* of all Powers and Roots, I had from the Honourable *Fr. Robarts*, Eſquire.

If a Quantity gradually increaſes or decreaſes, its immediate Increment or Decrement is called its *Fluxion*.

Or the *fluxion* of a Quantity is its Increaſe or Decreaſe indefinitely ſmall.

Let a Quantity x be put into *fluxion*, whereby it becomes $x\,\dot{x} + x$ ($\dot{x}$ repreſenting an Increment or Decrement indefinitely little, being called the *Fluxion* of x).

Now the fluxion of all the Powers, and of all the Roots of x, may be found by this general Rule:

As $x + \dot{x}$ contains the ſimple Quantity and its *Fluxion*; ſo the Square, Cube, &c. and the Square Root, Cube Root, &c. of $x + \dot{x}$ muſt contain the reſpective Powers or Roots of x with its *Fluxion* reſpectively.

And conſequently, if the flowing Quantity be reſpectively ſubſtracted, the *Fluxion* only muſt remain.

Thus the *Fluxion* of $x\,x$, is $\overline{x + \dot{x}}\;\overline{x + \dot{x}} - x\,x = 2\,x\,\dot{x} + \dot{x}\,\dot{x}$: And the *Fluxion* of $x\,x\,x$ is $\overline{x + \dot{x}} \times \overline{2\,x\,\dot{x} + \dot{x}\,\dot{x} + x\,x} - x\,x\,x = 3\,x\,x\,\dot{x} + 3\,\dot{x}\,\dot{x}\,x + \dot{x}\,\dot{x}\,\dot{x}$.

But ſince $x\,x$, part of the *Fluxion* of $x\,x$, is infinitely ſmaller than $2\,x\,\dot{x}$, whereby it can make no ſenſible Change in that Quantity, it may be laid aſide as of no Value.

And for the ſame Reaſon, $3\,x\,\dot{x}\,\dot{x} + \ddot{x}\,x\,\dot{x}$ may be left out of the *Fluxion* of $x\,x\,x$; ſo that their remains only

$$\left.\begin{matrix} 2\,x\,\dot{x} \\ 3\,x\,x\,\dot{x} \end{matrix}\right\}\text{ for the } \textit{Fluxion} \text{ of } \left\{\begin{matrix} x\,x \\ x\,x\,x \end{matrix}\right.$$

Thus alſo the *Fluxion* of $\sqrt{x}$ is $\sqrt{x + \dot{x}} - \sqrt{x} = \frac{\dot{x}}{2\sqrt{x}}$; which will be evident, by only extracting the ſquare Root of $x + \dot{x}$ according to the common Method, thus,

$$\left.\begin{array}{llll} & x + \dot{x}\,\Big(\sqrt{x} + \frac{\dot{x}}{2\sqrt{x}} & & \\ & \underline{x} & & \\ 2\sqrt{x}) & 0 + \dot{x} & & \\ & \quad\underline{\dot{x}} & & \\ & \quad 0 & & \frac{\dot{x}\,\dot{x}}{4x} \end{array}\right\}$$

The Fluxion of

$$\left.\begin{matrix} \sqrt[3]{x} \\ \\ \sqrt[3]{x} \\ \\ \sqrt{x\,x\,x} \end{matrix}\right\} = \left\{\begin{matrix} \frac{\ddot{x}}{3\sqrt[3]{x\,x}} \\ \\ \frac{2\,\ddot{x}\,x}{3\sqrt[3]{x\,x\,x\,x}} \\ \\ \frac{3\,x\,x\,\dot{x}}{2\sqrt{x\,x\,x}} \end{matrix}\right.$$

So that $\sqrt{x + \dot{x}}$ is equal to $\sqrt{x} + \frac{\dot{x}}{2\sqrt{x}}\sqrt{x}$, which is equal to $\frac{\dot{x}}{2\sqrt{x}}$ the *Fluxion* of $\sqrt{x}$, as above.

Indeed

ace this under article Fluxions

Plate. III.

Fig: 17 Fountain

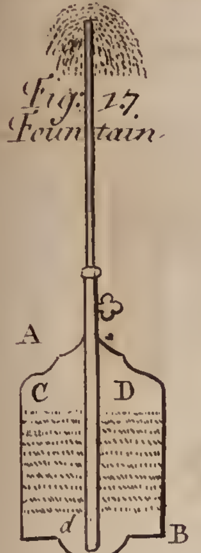


Fig 18 Fountain

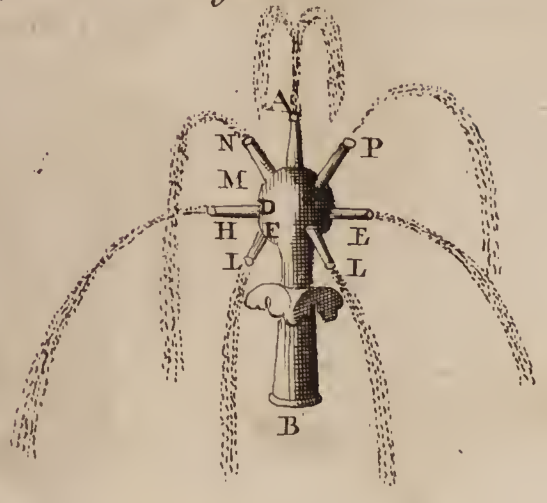
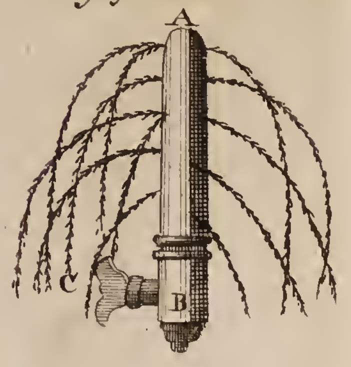


Fig 19 Fountain



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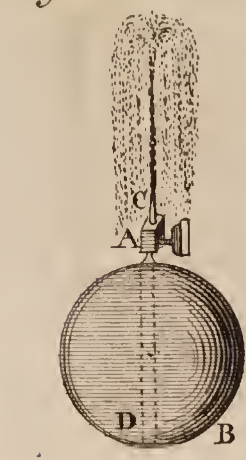


Fig 21 Fountain

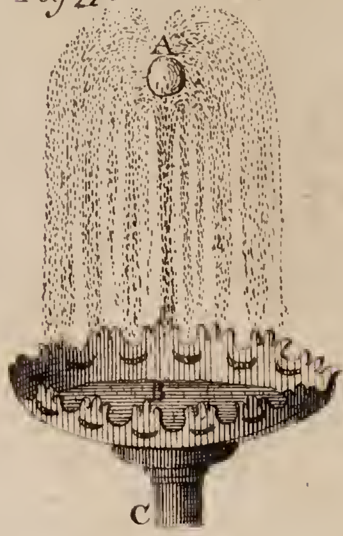


Fig 22 Fountain

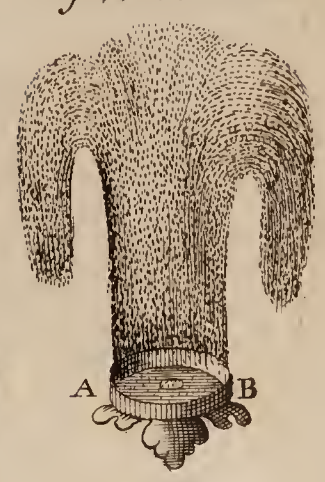


Fig 23 Fountain

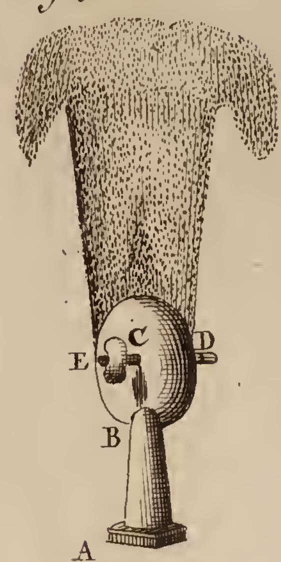


Fig 24 Fountain

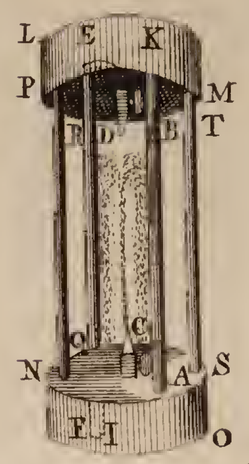
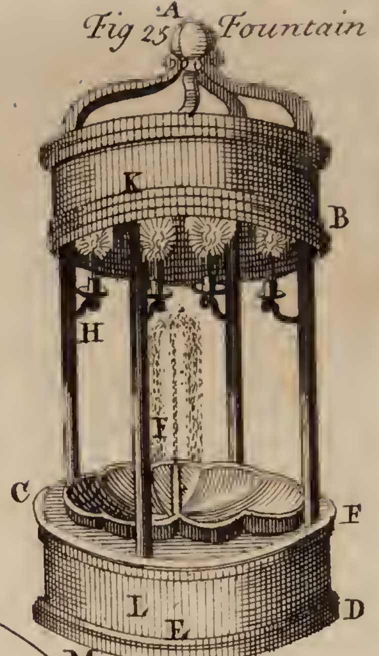
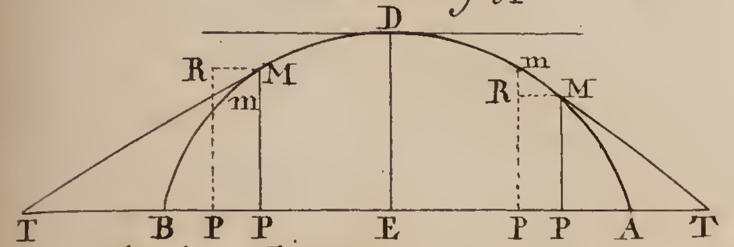
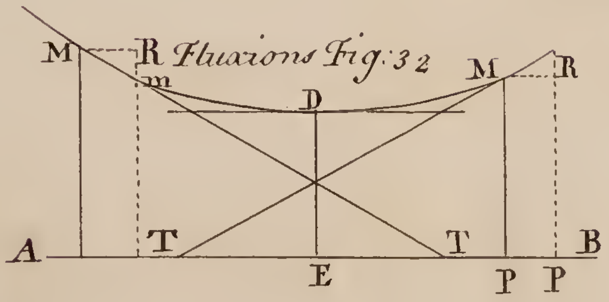


Fig 25 Fountain

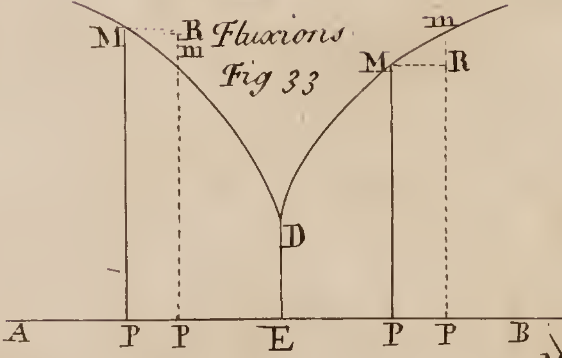


Fluxions Fig: 31



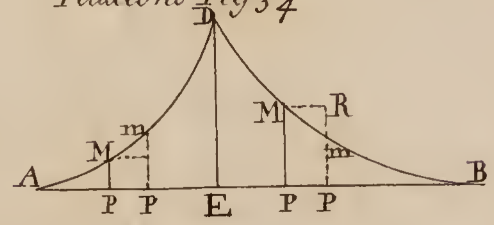


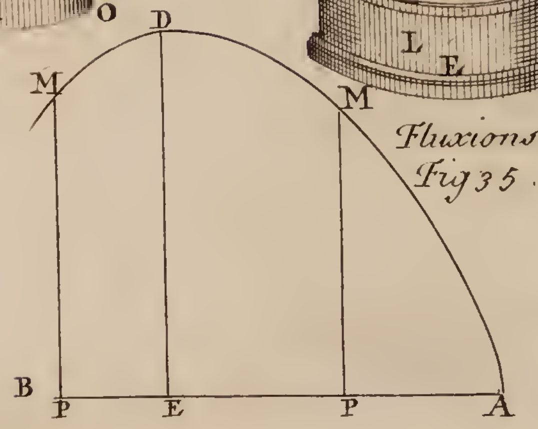
Fluxions Fig. 32



Fluxions Fig 33

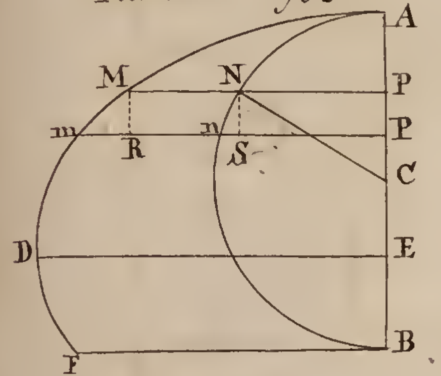
Fluxions Fig 34

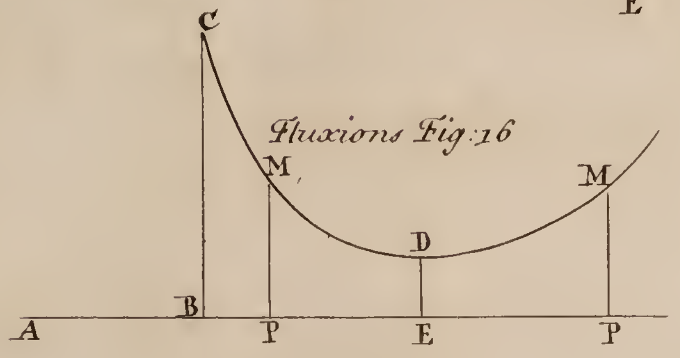




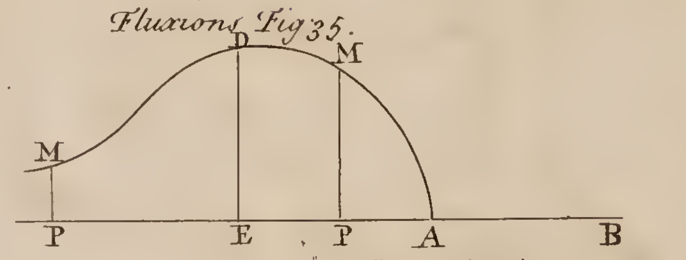
Fluxions Fig 35.

Fluxions Fig 36

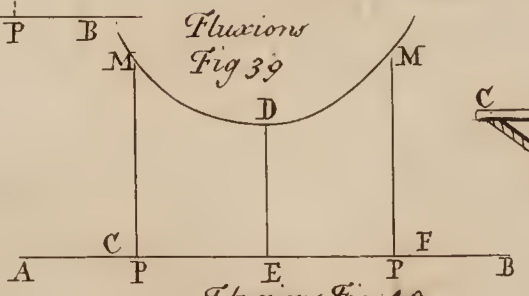




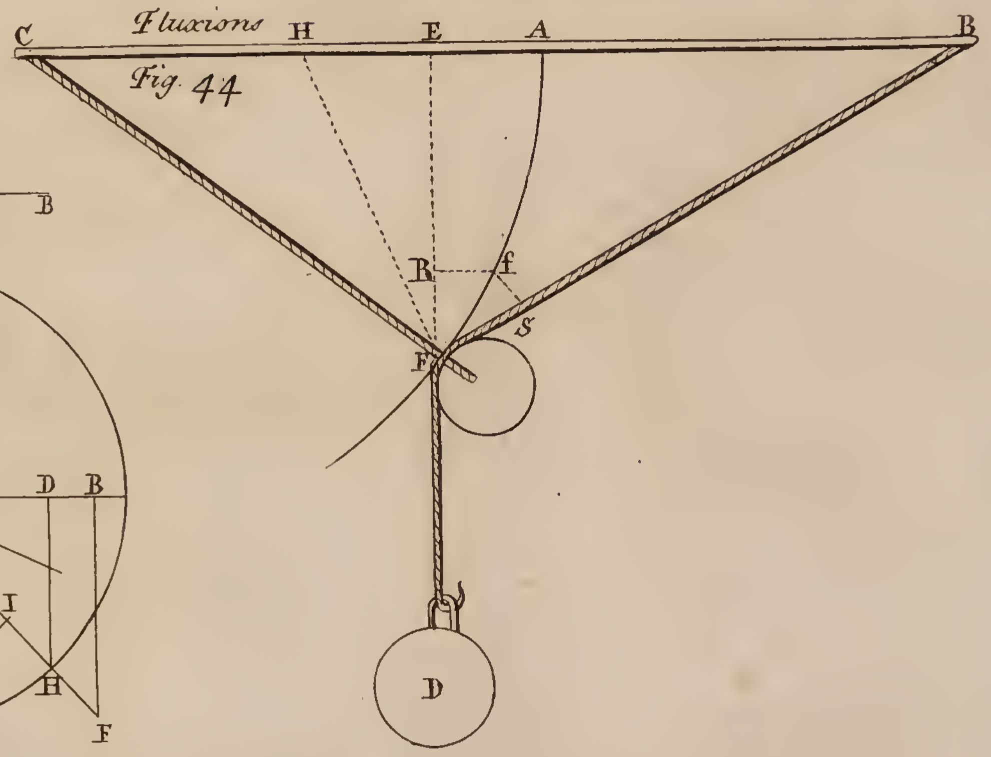
Fluxions Fig: 16



Fluxions Fig 35.

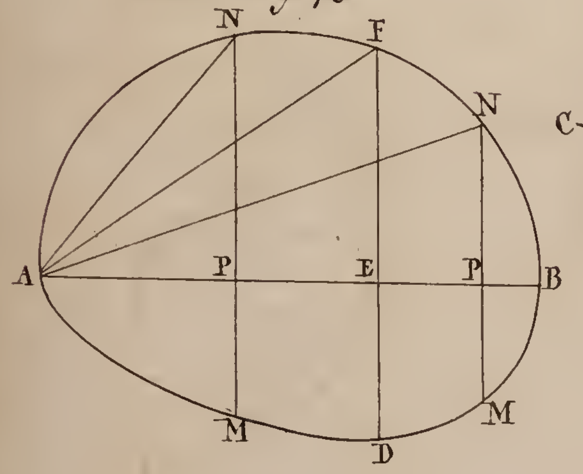


Fluxions Fig 39



Fluxions Fig 44

Fluxions Fig 40



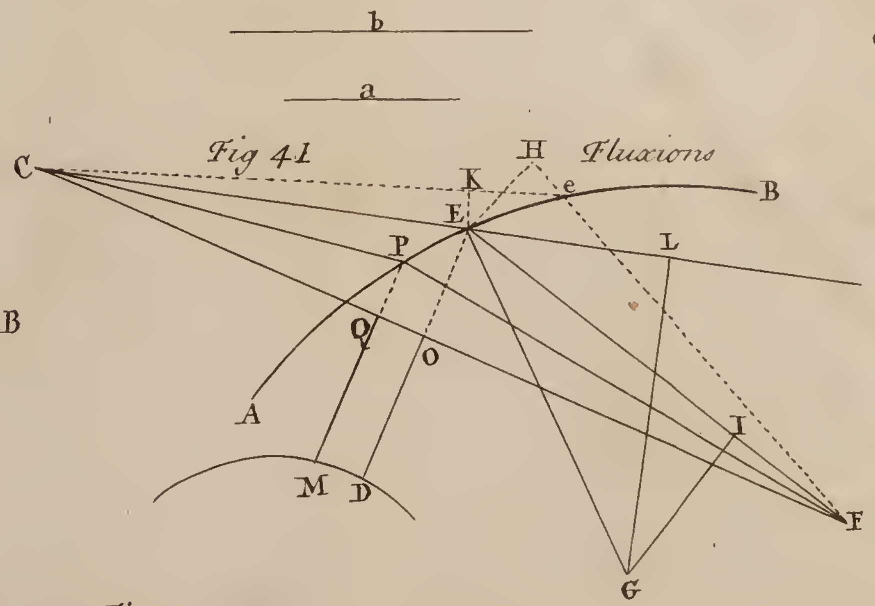
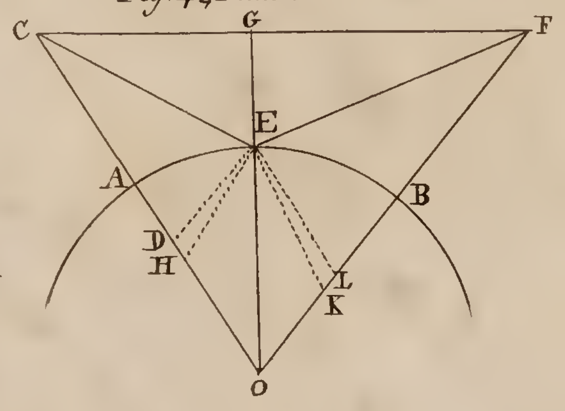
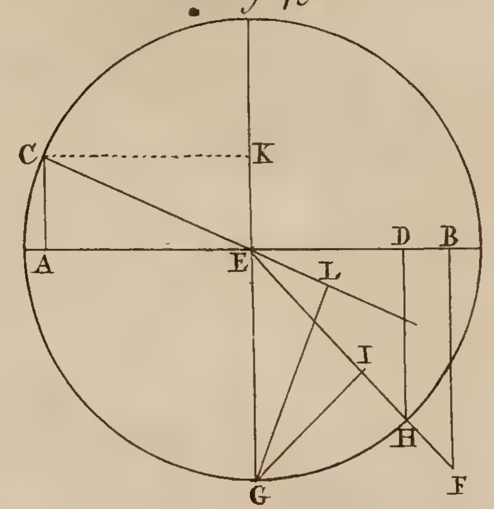


Fig 41 Fluxions

Fig 42 Fluxions



Fluxions Fig 43



Sector Fig: 30.

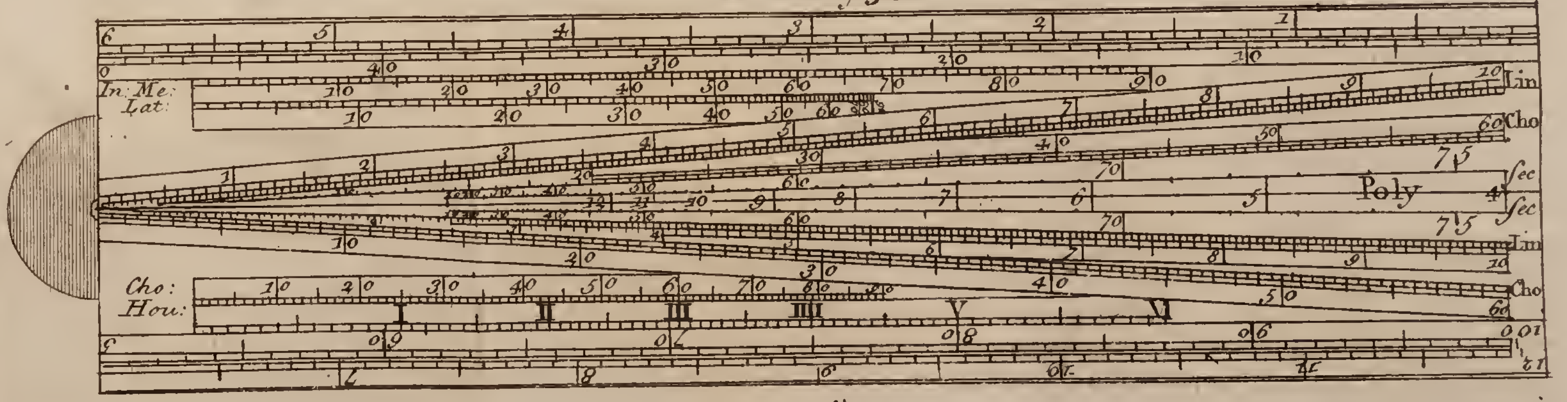


Fig: 25 Lens

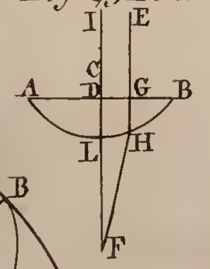


Fig 26 Lens

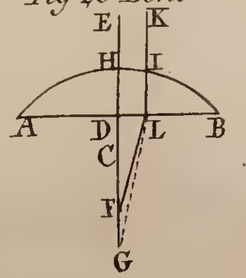
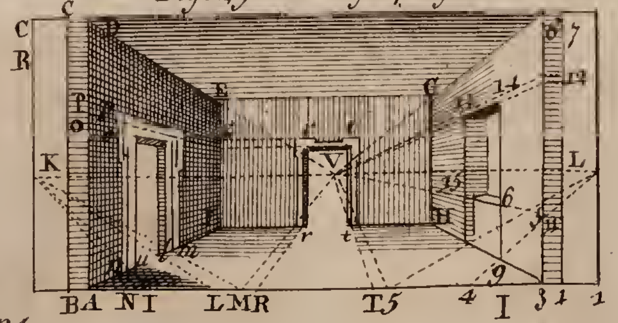
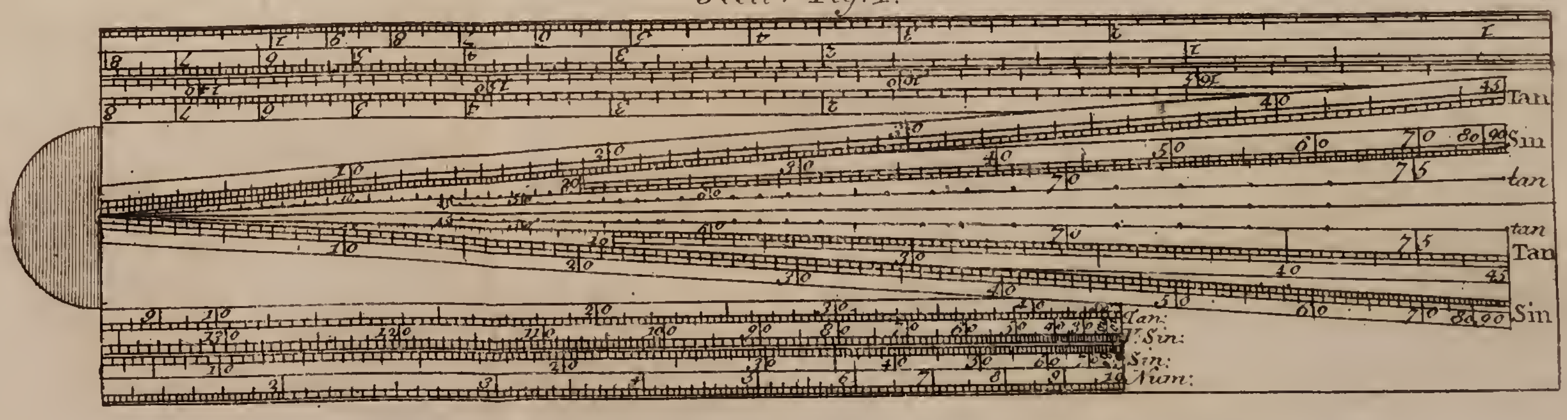
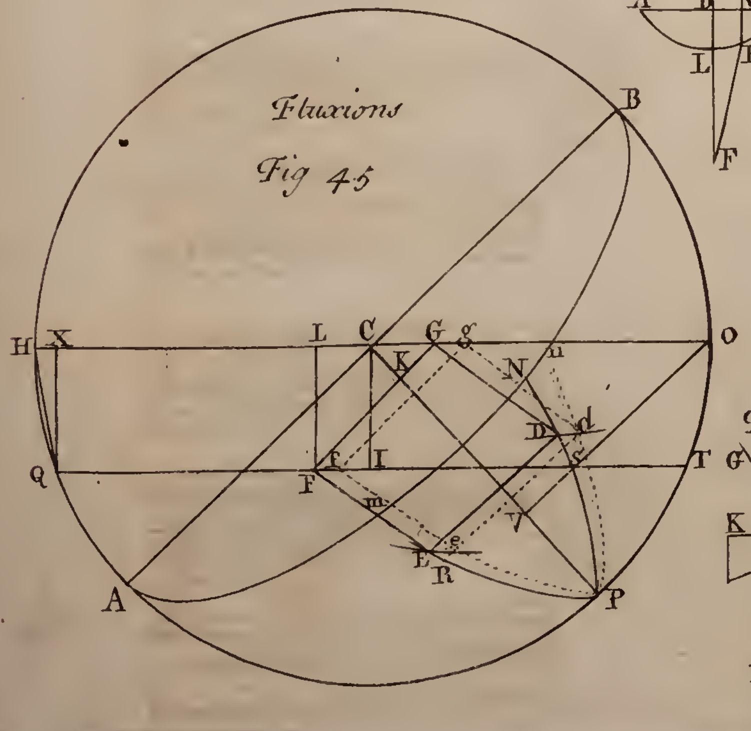


Fig: 29. Scenography



Sector Fig: 1.





Fluxions Fig 45

Fig: 27 Lens

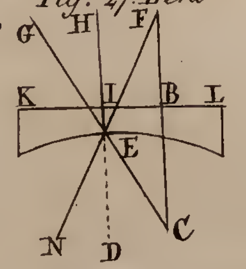
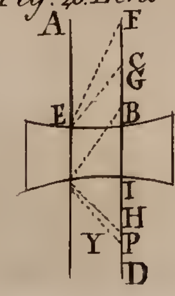


Fig. 28 Lens



B. Cole Sculp

Indeed $\sqrt{x} + \frac{\dot{x}}{2\sqrt{x}}$ is the true Root of $x + \dot{x} + \frac{\dot{x}\dot{x}}{4x}$ as the Operation ſhews, and conſequently ſomewhat bigger than the Root of $x + \dot{x}$. But $\frac{\dot{x}\dot{x}}{x4}$ being indefinitely leſs than what is annex'd to the difference between $x + \dot{x} + \frac{\dot{x}\dot{x}}{4x}$ and $x + \dot{x}$, may be conſider'd as of no Value. Wherefore $\sqrt{x} + \frac{\dot{x}}{2\sqrt{x}}$ may be taken for the true Root of $x + \dot{x}$.

Authors Names who have written of *Fluxions:*

D. Bernoulli Tractatus de Principiis Calculi Exponentialis.

Nieuwentyt's *Analyſis Infinitorum. Amſter.* 1695.

Dr. *Cheyne*'s *Fluxions*, with *Moivre*'s *Animadverſions* on them; and the Doctor's Reply.

Hays's *Fluxions. Lond.* 1704.

Analyſe des Infiniment Petits. Par l' Hoſpital Fr. Paris, 1696.

Le Calcule Integrale, par M. Carre. Paris, 1700.

Mr. *Abraham de Moiver*'s Uſe of *Fluxions*, in the Solution of Geometrical Problems. See *Philoſ. Tranſ. N.* 216.

Mr. *Humphrey Ditton*'s Inſtitution of Fluxions.

FLUXIONS. Sir *Iſaac Newton*, in his admirable *Princip. Phil. Math. P.* 250. lays down this *Lemma.*

> *That the* Moment *of any generated Quantity, is equal to the Moments of all the ſeveral generating Terms, multiplied into the Indices of their Powers, and into their Coefficients continually.*

Let a, b, c, &c. repreſent the Moments of any Quantities A, B, C, &c. increaſing or decreaſing by a perpetual fluxion; then will the Moment or Mutation of the Rectangle AB be $Ab + aB$; and of the Content of ABC, the Moment will be $ABc + AbC + aBC$: and of the Powers A^2, A^3, A^4, the Moments will be $2aA$, $3aA^2$, $4aA^3$; and the Moments of $A^{\frac{1}{2}}$, $A^{\frac{3}{2}}$, $A^{\frac{1}{3}}$, $A^{\frac{2}{3}}$, $\frac{1}{A}$, $\frac{1}{A^2}$, $\frac{1}{A^{\frac{2}{3}}}$, will be $\frac{1}{2}aA^{-\frac{1}{2}}$, $\frac{3}{2}aA^{\frac{1}{2}}$, $\frac{1}{3}aA^{-\frac{2}{3}}$, $\frac{2}{3}aA^{-\frac{1}{3}}$, $-aA^{-2}$, $-2aA^{-3}$, and $-\frac{2}{3}aA^{-\frac{5}{3}}$ reſpectively.

And generally, the Moment of any Power; ſuppoſe $A^{\frac{n}{m}}$, will be $\frac{n}{m}aA^{\frac{n-m}{m}}$, &c.

The Demonſtration of which *Lemma* is this.

CASE I.

Suppoſe any Rectangle, as AB, made or increaſed by a perpetual Motion; and from the Sides AB, let there be ſubſtracted the $\frac{1}{2}$ Moments, as $\frac{1}{2}a$ and $\frac{1}{2}b$: Then it will ſtand $A - \frac{1}{2}a$, and $B - \frac{1}{2}b$. Multiply them into each other, and there will ariſe $AB - \frac{1}{2}aB - \frac{1}{2}bA + \frac{1}{4}ab$.

Suppoſe alſo A and B increaſed by the half Moments, as $A + \frac{1}{2}a$, and $B + \frac{1}{2}b$; and that thoſe thus augmented Quantities were multiplied by one another; then there will ariſe $AB + \frac{1}{2}aB + \frac{1}{2}Ab + \frac{1}{4}ab$ for the Product: From which ſubducting the former Rectangle $AB - \frac{1}{2}aB - \frac{1}{2}bA + \frac{1}{4}ab$, the difference will be $aB + Ab$. *Q. E. D.* Which is the firſt Inſtance.

CASE II.

Let AB be $=$ to G: This multiplied by C, gives GC, or ABC; and its Moment, by the laſt *Caſe*, will be $gC + Gc$; that is, (if inſtead of G and g, you had put AB and $AB + Ab$) $aBC + AbC + ABc$. And thus it will ever be in the Quantities produced by continual Multiplication of unequal Factors.

CASE III.

Let A, B, and C, be all equal; and then the Moment of A^2, or of the Rectangle AB, will be $2aA = aB + Ab$; and the Moment of ABC, or A^3, will be $3aA^2 = aBC + AbC + ABc$. And in the like manner if n repreſent the Index of any Power of A, the Moment of A^n will be naA^{n-1}. *Q. E. D.*

CASE IV.

Wherefore, ſince $\frac{1}{A}$ multiplied by $A = 1$, the Moment of $\frac{1}{A}$ multiplied by A, together with $\frac{1}{A}$ multiplied by a, will be the Moment of 1; that is, nothing.

Further, the Moment of $\frac{1}{A}$, or A^{-1}, is $\frac{-a}{A^2}$. And generally, ſince $\frac{1}{A^n}$ multiplied by $A^n = 1$, the Moments of $\frac{1}{A^n}$ multiplied by A^n, together with $\frac{1}{A^n}$ multiplied by naA^{n-1}, will be nothing. And conſequently the Moment of $\frac{1}{A^n}$, or A^{-n}, will be $-\frac{a}{A^{n+1}}$. *Q. E. D.*

CASE V.

And ſince $A^{\frac{1}{2}}$ into $A^{\frac{1}{2}}$, produces A, the Moment of $A^{\frac{1}{2}}$ into $2A^{\frac{1}{2}}$, will be a, (by *Caſe* 3.) and therefore the Moment of $A^{\frac{1}{2}}$ will be $\frac{a}{2A^{\frac{1}{2}}}$, or $\frac{1}{2}aA^{-\frac{1}{2}}$. And generally, if $A^{\frac{m}{n}}$ be put equal to B, A^m ſhall be equal to B^n; and conſequently $maA^{m-1} =$ to nbB^{n-1}, and maA^{-1} equal to nbB^{-1}, or nb: And therefore $\frac{m}{n}aA^{\frac{m-n}{n}}$, is equal to $b A^{\frac{m}{n}}$; *i. e.* is equal to the Moment of $A^{\frac{m}{n}}$. *Q. E. D.*

CASE VI.

Wherefore the Moment of any generated Quantity $A^m B^n$, is the Moment of A^m multiplied by B^n, together with the Moment of B^n multiplied into A^m; that is, $maA^{m-1} + nbB^{n-1}$. And this whether the Indices of the Powers be Integers or Fractions, Affirmative or Negative.

And the ſame Reaſon holds in the Products of any Numbers multiplied by themſelves continually, as long as you pleaſe, or to as high Powers as you will. *Q. E. D.*

On which Foundations, the Algorithm of Fluxions, according to our way of Notation, may be thus eſtabliſhed; as I have before ſhewed in a good meaſure at the End of my Algebra, *Pag.* 115.

Where I ſhew, That by *the Doctrine of Fluxions*, we are to underſtand the Arithmetick of the *infinitely ſmall* Increments or Decrements of *indeterminate* or *variable Quantities*; or as ſome call them, the *Moments* or *infinitely ſmall Differences* of ſuch variable Quantities. Theſe infinitely ſmall Increments or Decrements our incomparable Sir *Iſaac Newton* calls very properly by this Name of *Fluxions*: For, as indeterminate and variable Quantities, *viz.* ſuch as in the Generation of Curvilineal and other Figures, by Local Motion, are continually encreaſing or diminiſhing, he rightly denominates *flowing Quantities*, as being ſuch as are perpetually augmented or leſſened, by the Flux or Motion of a *Line*, *Surface*, *&c.* So he calls the *Celerity* or *Velocity* of the Augmentation or Diminution of theſe *flowing Quantities* by the Name of *Fluxions*. And becauſe all Figures may be conceived to be generated by Local Motion, as is now very commonly ſuppoſed among Geometers, therefore 'tis much more natural to conceive the infinitely ſmall Increments or Decrements of the variable and *flowing Quantities* under the Notion of *Fluxions*, than under that of *Moments*, or infinitely ſmall *Differences*, as *Leibnitz*, *Niewentiit*, and the Noble Author of *Analyſe des Infiniment Petits* choſe rather to take them; though even that Way alſo is not without its Uſe in many Caſes.

The Excellent Sir *Iſaac Newton* ſuppoſes the *Abſciſſa* of a Curve, or any other flowing or variable Quantity to be uniformly augmented; and therefore for its *Fluxion* he puts 1 or Unity; and the other flowing Quantities he denotes uſually by the Letters v, x, y, z, and expreſſes their *Fluxions* by only repeating the ſame Letters with Points or Pricks over their Heads; thus, $\dot{v}$, $\dot{x}$, $\dot{y}$, $\dot{z}$, which are the *Fluxions* of the former flowing Quantities. And this Method is much more natural and ſhorter than *Niewentiit*'s, or the *French* one with the Differential *d* multiplied into the flowing Quantity, to denote the *Fluxion*.

And becauſe theſe *Fluxions* themſelves are alſo indeterminate and variable Quantities, and do continually increaſe or decreaſe, or grow greater or leſſer; therefore he conſiders the Velocities with which they do ſo increaſe or diminiſh, as the *Fluxions* of the former *Fluxions*: And thoſe may be called *Second Fluxions*, and are noted with two Points over them; thus, $\ddot{y}$, $\ddot{x}$, $\ddot{z}$. And if you go on again, and conſider the perpetual Augmentation or Diminution of *theſe*, as their *Fluxions* alſo, you may make third, fourth, or fifth *Fluxions*, &c. which will be noted thus, $\dddot{y}$, $\dddot{x}$, $\dddot{z}$; $\ddddot{y}$, $\ddddot{x}$, $\ddddot{z}$; $\overset{:\cdot:}{y}$, $\overset{:\cdot:}{x}$, $\overset{:\cdot:}{z}$; and ſo on *ad infinitum*. If the flowing Quantity be a Surd or a Fraction, he thus expreſſes its *Fluxion*; let the Surd be $\sqrt{:\overline{a-b}}$, its *Fluxion* is $\overset{\cdot}{\overline{\sqrt{:a-b}}}$; and the *Fluxion* of the Fraction $\dfrac{xx}{d-y}$ is $\overset{\cdot}{\overline{\dfrac{x\ x}{d-y}}}$. See Dr. *Wallis*'s *Algebra*, *Lat. Edit. Pag.* 392.

The main Buſineſs of the Algorithm or Arithmetick of Fluxions conſiſts in theſe two Things:

I. *From the flowing Quantity given, to find the Fluxion.*

II. *From the Fluxion, to find the flowing Quantity.*

As to the former of theſe, the Learned Dr. *Wallis*, in the Place above-mention'd, (from Sir *Iſaac Newton*'s Papers) gives this general Rule.

> *Let each Term of the Equation be multiplied ſeparately by the ſeveral Indexes of the Powers of all the flowing Quantities contain'd in that Term: And in every ſuch Multiplication let one Root or Letter of the Power be changed into its proper Fluxion: So ſhall the Aggregate of all the Products connected together by their proper Signs, be the Fluxion of the Equation deſired.*

And all the Caſes of it are demonſtrated by Sir *Iſaac Newton* in the *Lemma* above delivered, which I ſhall exemplify by particular Inſtances.

I. In the General; To expreſs the *Fluxions* of ſimple variable Quantities, as was ſaid before, you need only uſe the Letter or Letters which expreſs them, with a ſmall Point over their Heads: Thus, the Fluxion of x is $\dot{x}$, and the *Fluxion* of y is $\dot{y}$, and the *Fluxion* of $x + y + v + z$, is $\dot{x} + \dot{y} + \dot{v} + \dot{z}$, *&c.*

And (inverſely) the *flowing Quantities* in this Caſe, will be eaſily had from the Fluxions, by only writing the Letters without the Points over them.

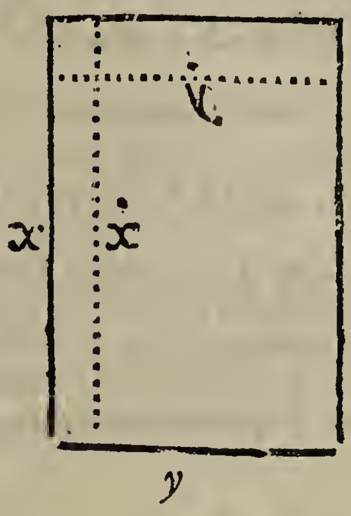
> *N. B.* For the fluxion of permanent Quantities, when any ſuch are in the Equation, you muſt imagine 0 or a Cypher; for ſuch Quantities can have no Fluxions, properly ſpeaking, becauſe they are without Motion, or invariable.

II. To find the Fluxions of the Products of two or more variable or flowing Quantities: *Multiply the Fluxion of each Simple Quantity by the Factors of the Products, or the Product of all the reſt, and connect the laſt Products by their proper Signs; the Sum or Aggregate is the Fluxion ſought.*

Thus, the Fluxion of $x y$, is $x \dot{y} + \dot{x} y$; and the Fluxion of $x y z$, is $x y \dot{z} + x \dot{y} z + \dot{x} y z$; and the Fluxion of $x v y z$, is $x v y \dot{z} + x v \dot{y} z + x \dot{v} y z + \dot{x} v y z$; and the Fluxion of $\overline{a + x} \times$ by $\overline{b - y}$ (the common Product being $a b + b x - y a - x y$) will be $b \dot{x} - \dot{y} a - \dot{x} y - x \dot{y}$.

Demonſtration of Rule 2.

Suppoſe $x y =$ to any Rectangle made or increaſed by a perpetual Motion or Fluxions of either of the Sides x or y along the other; and let the Moments or Fluxions of the Sides be $\dot{x}$ and $\dot{y}$: By which we underſtand the *Velocity* with which either Side moves to form the Rectangle.



From the Sides ſubduct the half Fluxions of thoſe Sides, and it will ſtand thus; $x - \frac{\dot{x}}{2}$, and $y - \frac{\dot{y}}{2}$.

Multiply theſe one into another, and the Product will be $xy - \frac{y\dot{x}}{2} - \frac{x\dot{y}}{2} + \frac{\dot{x}\dot{y}}{4}$:

Then to the Sides add the half Moments or Fluxions, and it will be thus; $x + \frac{\dot{x}}{2}$; and $y + \frac{\dot{y}}{2}$: Which multiplied alſo into one another, will produce $xy + \frac{y\dot{x}}{2} + \frac{x\dot{y}}{2} + \frac{\dot{x}\dot{y}}{4}$.

After which ſubſtract the former Product from this laſt, and the difference will be only $x\dot{y} + \dot{x}y$, the Fluxion of xy, according to the Rule.

The Inverſe of this Rule finds alſo (in this Caſe) the flowing Quantity from the Fluxion, *viz.* if each Member of the Fluxion be divided by the fluxionary Quantity or Letter, or by changing the fluxionary Letter into that proper flowing Quantity of which it is the Fluxion; for then the Quotes connected by their proper Signs, will be the flowing Quantities ſought: Only if the Letters be all exactly the ſame, the flowing Quantity will be a ſimple one, whoſe Parts are not to be connected together by the Signs + and —, as in the firſt three Examples of this Rule.

III. To find the Fluxion of any Fraction; *Multiply the Fluxion of the Numerator by the Denominator, and after it place (with the Sign —) the Fluxion of the Denominator to the Numerator, and divide the whole by the Square of the Denominator:*

Thus, the Fluxion of $\frac{x}{y}$ is $\frac{\dot{x}y - x\dot{y}}{yy}$; for ſuppoſe $\frac{x}{y} = z$, then will $x = yz$; which equal Quantities will have equal Fluxions; therefore $\dot{x} = \dot{y}z + \dot{z}y$, and $\dot{x} - z\dot{y} = \dot{z}y$; and dividing all by $y\ \frac{\dot{x} - z\dot{y}}{y} = \dot{z} =$ (becauſe $\frac{x}{y} = z$) $\frac{y\dot{x} - x\dot{y}}{yy}$: Wherefore this laſt is the Fluxion of the Fraction $\frac{x}{y} = z$; becauſe z being $= \frac{x}{y}$, $\dot{z}$ will be equal to the Fluxion of $\frac{x}{y}$. And the Fluxion of $\frac{a}{x}$ will be $\frac{-\dot{x}a}{xx}$; for the permanent Quantity a having no Fluxion, there can be no Product of the Fluxion of the Numerator into the Denominator, as there would have been, had a been x, z, or any other variable Quantity.

Alſo the Fluxion of $\frac{x}{a}$ will be $\frac{\dot{x}a}{aa}$, and the Fluxion of $\frac{x}{a+x}$, will be $\frac{\dot{x}a + \dot{x}x - \dot{x}a}{aa + 2ax + xx}$ or $\frac{\dot{x}a}{aa + 2ax + xx}$; becauſe $-\dot{x}x$ and $+\dot{x}x$ deſtroy one another: Alſo the Fluxion of $\frac{1}{x}$ or x^{-1}, is $\left(\frac{-\dot{x}}{x^2}.\right)$ Here alſo the Reverſe of the Rule ſerves to find the flowing Quantity from the Fluxion: As if the flowing Quantity of the Fraction were required, $\frac{\dot{x}y - x\dot{y}}{yy}$; Firſt multiply it by the Square of the Denominator, and it will be $\dot{x}y - x\dot{y}$; from which take away $- x\dot{y}$, which was placed after it, and it will be $\dot{x}y$; omit the Point and 'tis xy, which, becauſe y is the Denominator of a Fraction, will at laſt be $\frac{x}{y}$.

Before the Fluxions of any Power, whether perfect or imperfect, can be found, the following way of Notation muſt be well underſtood.

If a Series of Geometrical Progreſſionals be in this Order,

$$1.\ x.\ xx.\ x^3.\ x^4.\ x^5.\ x^6.\ x^7.\ \&c.$$

Their Indexes or Exponents will be in Arithmetical Progreſſion, and ſtand thus;

$$0,\ 1.\ 2.\ 3.\ 4.\ 5.\ 6.\ 7.$$

But if they are Fractions, as

$$\frac{1}{x}\ \ \frac{1}{x}\ \ \frac{1}{x^3}\ \ \frac{1}{x^4}\ \ \frac{1}{x^5}\ \ \frac{1}{x^6}\ \ \frac{1}{x^7}.$$

Then their Exponents will be Negative, and ſtand thus, — 1. — 2. — 3. — 4. — 5. — 6. — 7.

For if you ſuppoſe $x = 2$, then will $\frac{1}{x} = 1$, and $\frac{1}{xx} = \frac{1}{4}$, and $\frac{1}{x^3} = \frac{1}{8}$, &c.

Or if you expreſs the Geometrical Series by means of the Exponents, it will ſtand thus, x^{-1}, x^{-2}, &c. and if it were expreſſed thus, x^0, then it will be $x^0 = 1$; becauſe 2 is the Denominator of the Ratio, in which Unity is not affected. Thus alſo $\frac{1}{x^4} = x^{-4}$, and $\frac{1}{x^3} = x^{-3}$; and $1 = x^0$; $x^1 = x$, $x^2 = xx$, &c.

Alſo the Exponent of $\sqrt{:}\,x$ will be $\frac{1}{2}$, becauſe as $\sqrt{:}\,x$, is a Mean Proportional between 1 and x; ſo $\frac{1}{2}$ is an Arithmetical Mean between 0 and 1.

And the Exponent of $\sqrt[3]{:}\,x$ will be $\frac{1}{3}$, becauſe as $\sqrt[3]{:}\,x$ is the firſt of the two Mean Proportionals between 1 and x; ſo $\frac{1}{3}$ is the firſt of the two Arithmetical Means between 0 and 1.

For ſince $1.\ \overset{2}{x}.\ \overset{4}{xx}.\ \overset{8}{xxx}.$ are continually Proportional, therefore their Cubes, or any other Roots, will be alſo continually Proportional; that is, $\sqrt[3]{}:1\,(=1).\ \sqrt[3]{x}.\ \sqrt[3]{}:xx.\ \sqrt[3]{xxx}\,(=x)\div$.

So alſo,

$1.\ x.\ xx.\ x^3.\ x^4.\ x^5.\div:$ Wherefore the Roots of the 5th Power of thoſe Quantities will be $\div$;

That is,

$\sqrt[5]{1}.\ \sqrt[5]{x}.\ \sqrt[5]{x^2}.\ \sqrt[5]{x^3}.\ \sqrt[5]{x^4}.\ \sqrt[5]{x^5}.\ (=x.)$
Alſo, for the ſame Reaſon, the Exponent of $\sqrt[5]{}:x^4$, will be $\frac{4}{5}$.

N. B. Always place the Index of the Letter (or Power) over that of the radical Sign.

Thus, in Fractions, the Exponent of $\frac{1}{x}$ will be -1, of $\frac{1}{\sqrt{}:x^3}$ will be $-\frac{3}{2}$, of $\frac{1}{\sqrt[3]{}:x^5}$ will be $-\frac{5}{3}$, of $\frac{1}{\sqrt{}:x^7}$ will be $-\frac{7}{2}$, &c.

N. B. $\sqrt{}:x$ and $x^{\frac{1}{2}}$, or $\sqrt[3]{}:x$ and $x^{\frac{1}{3}}$, or $\sqrt[5]{}:x^4$, and $x^{\frac{4}{5}}$, are only two different ways of Notation for one and the ſame thing, the former in the *old*, the latter in the *new* way.

So likewiſe $\frac{1}{x}$ and x^{-1} are all one; and $\frac{3}{x}$ is x^{-3}, &c.
The way of reading or expreſſing Quantities ſo denoted is thus; x^{-3} is Unity divided by the Cube of x, and if it were $x^{-\frac{7}{3}}$, it muſt be read, Unity or One, divided by the Cube Root of the ſeventh Power of x.

Note alſo, That the Sum of any two Exponents of two Numbers or Quantities, in any Geometrick Progreſſion, makes the Exponent of the Product of thoſe two Terms.

Thus, $x^{\frac{1}{2}+\frac{1}{3}}$, or $x^{\frac{5}{6}}$, is the way of expreſſing the Product of $x^{\frac{1}{3}}$ into $x^{\frac{1}{2}}$, and $x^{-\frac{1}{3}+\frac{1}{5}}$, or $x^{-\frac{2}{15}}$, is the Product of $x^{-\frac{1}{3}}$ into $x^{\frac{1}{5}}$.
Alſo $x^{-\frac{1}{3}-\frac{1}{3}}$, or $x^{-\frac{2}{3}}$, is the Product of $x^{-\frac{1}{3}}$ into it ſelf, or the Square of $x^{-\frac{1}{3}}$.

And the difference between the Exponents of any two Terms, is the Exponent of the Quotient ariſing by Diviſion of the greater by the leſs.

Thus, $x^{\frac{1}{2}-\frac{1}{3}}$, or $x^{\frac{1}{6}}$, is the Exponent of the Quotient of $x^{\frac{1}{2}}$ by $x^{\frac{1}{3}}$, &c.
Let p repreſent the Exponent of N, any Number at pleaſure; and let $p=1$.
Then will $N^p = N^1$, $N^{p+1} = N^2$, and $N^{p+2} = N^3$, $N^{p+3} = N^4$, &c.

Or if $p = 33$.

Then will $N^p = N^3$, and $N^{p+3} = N^6$, &c.

And Negatively,

$N^{-p} = N^3$, and $N^{p+3} = N^6$: &c.

Alſo, as 0 is an Arithmetical Mean between a Poſitive and a Negative Quantity equally diſtant from it; *(i.e.)* $-6.\ 0.\ 6$ are Arithmetically Proportional: So is 1 a Geometrical Mean between an Affirmative and Negative Power, at equal diſtances from it.

That is, $N^{-p}.\ 1.\ N^{p}\div$.
Wherefore $1 = N^{-p} \times N^{p}$. And dividing all by N^p, $\frac{1}{Np} = N^{-p}$.
So that $\frac{1}{N^2p}$ is all one with N^{-2p}.

And to add ſome Examples of Multiplication and Diviſion in this way,

$\frac{1}{x} \times \frac{1}{\sqrt[3]{x^5}} = x^{-1} \times x^{\frac{5}{3}} = {}^{-\frac{3}{3}} \times x^{\frac{5}{3}} = x^{-\frac{8}{3}} = \frac{1}{x^{\frac{8}{3}}} = \frac{1}{\sqrt[3]{x^8}}$, &c.

And $\frac{1}{\sqrt[3]{x^5}}$ divided by $\frac{1}{x}$ will ſtand in this Notation thus; $\frac{1}{x}\Big)\,\frac{1}{\sqrt[3]{x^5}}\,(= x^{-1})\ x^{-\frac{5}{3}}\,(= x^{-\frac{8}{3}})$ $x^{-\frac{5}{3}} = (x^{-\frac{2}{3}} = \frac{1}{\sqrt[3]{xx}}$, &c.

IV. This being well underſtood, there is this general Rule for the finding the Fluxion of any Power, whether Perfect or Imperfect, *viz. Multiply the Power (firſt brought one Degree lower) by the Index of that firſt Power; and then, that Product by the Fluxion of the Root.*

Thus the Fluxion of xx will be $2x\dot{x}$, for $xx = x \times x$; but the Fluxion of $x \times x = \dot{x}x + x\dot{x} = 2\dot{x}x$, &c. and the Fluxion of x^3 will be $3xx\dot{x}$. That of x^8 will be $8x^7\dot{x}$, &c. or if m expreſs the Index of any Power, as ſuppoſe x^m, then its Fluxion will be $mx^{m-1}\dot{x}$, or $m\dot{x}x^{m-1}$: For x^m brought one Degree lower (m being a general Index) muſt be x^{m-1}; then that × by m the Index, makes mx^{m-1}; and this laſt by the Fluxion of the Root produces $mx^{m-1}\dot{x}$.
If the Power be produced from a Binomial, &c. as ſuppoſe $xx + 2xy + yy$, its Fluxion will be $2\dot{x}x + 2x\dot{x} + 2\dot{x}y + 2y\dot{y}$, by working accor- to this fourth and the ſecond Rules.

If the Exponent be Negative, as ſuppoſe x^{-m}, or $\frac{1}{x^m}$, its Fluxion will be $-m\dot{x}x^{-m-1}$: Or if you would do it by way of Fraction, $\frac{-mx^{m-1}\dot{x}}{x^{2m}}$

(for the Square of x^m is as well x^{2m} as x^{m2}) or according to Sir *Iſ. Newton*'s Way, which is yet ſhorter, $\frac{-m\dot{x}}{x^{m+1}}$: See *Caſe* 4. *P.* 252. of his *Principia.*

If the Power be imperfect, *i. e.* if its Exponent be a Fraction, as ſuppoſe $\sqrt[n]{}:x^m$; or in the other Notation $x^{\frac{m}{n}}$, let us ſuppoſe $x^{\frac{m}{n}} = z$: Then if you raiſe up each Member to the Power of n, it will ſtand thus, $x^m = z^n$; the Fluxion of which will be, by this general Rule, $mx^{m-1}\dot{x} = nz^{n-1}\dot{z}$. Wherefore $\dot{z}$ will be $= \frac{m\dot{x}x^{m-1}}{nz^{n-1}}$ (by dividing both Parties by nz^{n-1};) and $\frac{m\dot{x}x^{m-1}}{nz^{n-1}} = \frac{m}{n}x^{\frac{m}{n}-1}\dot{x}$, or $\frac{m}{n}\dot{x}\sqrt[n]{}:x^{m-n}$, by putting inſtead of nz^{m-1}, its Value $nx^{m-\frac{m}{n}}$: So that to find the Fluxion of any kind of Power, you muſt proceed thus:

Multiply the Power given by its Index or Exponent, and then that Product by the Fluxion of the Root of the Power given; and after that ſubduct One or Unity from the Index of the Power.

As for the Fluxions of *Surd Quantities*, Mr. *Hayes* gives the following Examples in his Treatiſe of Fluxions lately printed, which will make the Thing plain to any one that will render himſelf ready at the Practice of this Art.

RULE V.

To find the Fluxions of Surd Quantities.

Let it be requir'd to find the Fluxion of $\sqrt{2rx-xx}$, or $\overline{2rx-xx}|^{\frac{1}{2}}$. Suppoſe $\overline{2rx-xx}|^{\frac{1}{2}} = z$; then is $2rx-xx = zz$; and conſequently $r\dot{x} - x\dot{x} = z\dot{z}$; and by Diviſion, $\frac{r\dot{x}-x\dot{x}}{z} = \dot{z} =$ (by Subſtitution) $\frac{r\dot{x}-x\dot{x}}{\sqrt{2rx-xx}} =$ to the Fluxion of $\sqrt{2rx-xx}$.

Let it be required to find the Fluxion of $\overline{ay-xx}|^3$; for $\overline{ay-xx}|^3$ put z, and then $ay - xx = z^{\frac{1}{3}}$, and $a\dot{y} - 2x\dot{x} = \frac{1}{3}z^{-\frac{2}{3}}\dot{z}$: And multiplying by 3, $3a\dot{y} - 6x\dot{x} = z^{-\frac{2}{3}}\dot{z}$; and conſequently, $3az^{\frac{2}{3}}\dot{y} - 6z^{\frac{2}{3}}x\dot{x} = \dot{z}$ equal (ſubſtituting $\overline{ay-xx}|^2 = z^{\frac{2}{3}}$) $3a^3y^2\dot{y} - 6a^2x^2y\dot{y} + 3ax^4\dot{y} - 6a^2y^2x\dot{x} + 12ayx^3\dot{x} - 6x^5\dot{x} =$ to the Fluxion of $\overline{ay-xx}^3$.

The Fluxions of imperfect Powers may be alſo inveſtigated by (*Art.* 20.) the General Rule, and expreſs'd otherwiſe, and more briefly, thus:

The Fluxion of $\overline{2rx-xx}|^{\frac{1}{2}}$, is equal $\frac{1}{2}\times\overline{2rx-xx}|^{-\frac{1}{2}}\times 2r\dot{x} - 2x\dot{x} = \frac{r\dot{x}-x\dot{x}}{\sqrt{2rx-xx}}$.

The Fluxion of $\overline{ay-xx}|^3$, is $= 3\times\overline{ay-xx}|^2\times a\dot{y} - 2x\dot{x}$; which being reduced, will be found equal to the Fluxion thereof formerly found.

The Fluxion of $\sqrt{xy+yy}$, is $= \frac{1}{2}\times\overline{xy+yy}|^{\frac{1}{2}}\times y\dot{x} + x\dot{y} + 2y\dot{y}$ (*Article* 15.) $\frac{y\dot{x}+x\dot{y}+2y\dot{y}}{2\sqrt{xy+yy}}$. The Fluxion of $\sqrt{a^4+axyy}$ is $= \frac{1}{2}\times\overline{a^4+axyy}|^{-\frac{1}{2}}\times ay^2\dot{x} + 2axy\dot{y} = \frac{ay^2\dot{x}+2axy\dot{y}}{2\sqrt{a^4+axyy}}$.

The Fluxion of $\sqrt{ax+xx+\sqrt{a^4+axyy}}$ is = (by the *Art.* 20. Rule, and the preceding Example)

$$= \frac{1}{2}\times\overline{ax+xx+\sqrt{a^4+axyy}}^{\frac{1}{2}}\times a\dot{x} + 2x\dot{x} + \frac{ay^2\dot{x}+2axy\dot{y}}{2\sqrt{a^4+axyy}}$$

$$= \frac{a\dot{x}+2x\dot{x}}{2\sqrt{ax+xx+\sqrt{a^4+axyy}}} + \frac{ay^2\dot{x}+2axy\dot{y}}{2\sqrt{ax+xx+\sqrt{a^4+axyy}}\times 2\sqrt{a^4+axyy}}$$

The Fluxion of $\frac{\sqrt[3]{ax+xx}}{\sqrt{xy+yy}}$, is (*Art.* 14. 20.) (finding the Fluxions of the Numerator and Denominator)

$$\frac{\frac{a\dot{x}-2x\dot{x}}{3\sqrt[3]{\overline{ax+xx}|^2}}\times\sqrt{xy+yy}\quad\frac{y\dot{x}+x\dot{y}+2y\dot{y}}{2\sqrt{xy+yy}}\times\sqrt[3]{ax+xx}}{xx+yy}$$

To find the Fluxions of Quantities compounded of Rational and Surd Quantities: Let it be requir'd to find the Fluxion of $\overline{bx^2+cax+ea^2}\,x\sqrt{xx+aa} = z$. Put $bx^2+cax+ea^2 = p$, and $\sqrt{xx+aa} = q$. Then the given Quantity is $pq = z$, and the Fluxion thereof is $p\dot{q} + q\dot{p} = \dot{z}$: But $\dot{q}$ is $= \frac{x\dot{x}}{\sqrt{xx+aa}}$ and $\dot{p}$ is $= 2bx\dot{x} + ca\dot{x}$; therefore in the Equation $p\dot{q} + q\dot{p} = \dot{z}$, if in place of p, q, $\dot{p}$, $\dot{q}$, we reſtore the Quantities they repreſent, we ſhall have $\frac{\overline{bx^3+cax^2+ea^2x}\times\dot{x}}{\sqrt{xx+aa}} + 2bx\times\sqrt{xx+aa}\times\dot{x} + ca\times\sqrt{xx+aa}\times\dot{x} = \dot{z}$.

Which being reduc'd to one Denomination, gives

$$\frac{\overline{3bx^3+2acx^2+ea^2x+2ba^2x+xa^3}\times\dot{x}}{\sqrt{xx+aa}}$$

$= \dot{z} =$ to the Fluxion of the given Quantity.

RULE VI.

To find the Fluxions of Powers, *where the* Exponents of thoſe Powers *are themſelves* fluent Quantities. *By Mr.* Humphry Ditton, *Maſter of the New Mathematical School in* Chriſt's Hoſpital.

Let z, y, x, and v, be flowing Quantities; the Varieties that may happen here, are reducible to theſe following Caſes.

It is either z^y, z^{y+x}, z^{yx}, $z^{\frac{y}{x}}$, z^{y^x}; in which laſt Caſe x is the Exponent of y, as y it ſelf is alſo of z.

CASE I.

Let $z^{\dot y}$ be propoſed, and ſuppoſe $z^y = v$; then $\overline{z+\dot z}|^{y+\dot y} = v+\dot v$, but $\overline{z+\dot z}|^{y+\dot y} = z^{y+\dot y} + y z^{y+\dot y-1}\dot z$ (rejecting all the conſequent Terms of the Series in which any Powers or Products of Fluxions would be found) *ergo* $v+\dot v = z^{y+\dot y} + y z^{y+\dot y-1}\dot z$, and $z^{y+\dot y} + y z^{y+\dot y-1}\dot z - v = \dot v$, but $v = z^y$; from whence $z^{y+\dot y} + y z^{y+\dot y-1}\dot z - z^y = \dot v$, is for that reaſon the Value of the Fluxion required.

CASE II.

2. Let $z^{y+x} = v$, then $\overline{z+\dot z}|^{y+\dot y+x+\dot x} = v+\dot v$, but $\overline{z+\dot z}|^{y+\dot y+x+\dot x} = z^{y+\dot y+x+\dot x} + y z^{y+\dot y+x+\dot x-1}\dot z + x z^{y+\dot y+x+\dot x-1}\dot z$; *ergo* $z^{y+\dot y+x+\dot x} + \overline{y+x} \times z^{y+\dot y+x+\dot x-1}\dot z - z^{y+x} = \dot v$.

CASE III.

3. Let $z^{yx} = v$, then $v+\dot v = \overline{z+\dot z}|^{yx+y\dot x+x\dot y} = z^{yx+y\dot x+x\dot y} + xy \times z^{yx+y\dot x+x\dot y-1}\dot z$, from whence ariſes $z^{yx+y\dot x+x\dot y} + xy \times z^{yx+y\dot x+x\dot y-1}\dot z - z^{yx} = \dot v$.

CASE IV.

4. Let $z^{\frac{y}{x}} = v$, then $v+\dot v = \overline{z+\dot z}|^{\frac{y}{x}+\frac{\dot y x - \dot x y}{xx}} = \overline{z+\dot z}|^{\frac{yx+x\dot y-y\dot x}{xx}} = z^{\frac{yx+x\dot y-y\dot x}{xx}} + \frac{y}{x} z^{\frac{yx+x\dot y-y\dot x}{xx}-1}\dot z$, thence $z^{\frac{yx+x\dot y-y\dot x}{xx}} + \frac{y}{x} z^{\frac{yx+x\dot y-y\dot x}{xx}-1}\dot z - z^{\frac{y}{x}} = \dot v$.

CASE V.

Laſtly, Let $z^{y^x} = v$, the Fluxion of $y^x = y^{x+\dot x} + x y^{x+\dot x-1}\dot y - y^x$; *ergo* we have $v+\dot v = \overline{z+\dot z}|^{y^x + y^{x+\dot x} + x y^{x+\dot x-1}\dot y - y^x} = \overline{z+\dot z}|^{y^{x+\dot x} + x y^{x+\dot x-1}\dot y} = z^{y^{x+\dot x} + x y^{x+\dot x-1}\dot y} + y^{x+\dot x} z^{y^{x+\dot x-1}\dot y-1}\dot z$; and thence it is plain, that $\dot v = z^{y^{x+\dot x} + x y^{x+\dot x-1}\dot y} + y^x z^{y^{x+\dot x}+x y^{x+\dot x-1}\dot y-1}\dot z - z^{y^x}$.

Next for the Rule *inverſely*, to find the flowing Quantity belonging to the Fluxion of any Power, whether Perfect, or Imperfect, proceed thus:

I. Take the fluxionary Letter or Letters out of the Equation.
II. Augment the Index of the Fluxion by 1 or Unity.
III. Divide the Fluxion by the Index of its Power ſo increaſed by Unity.

Examples.

If $3\dot x xx$ were propoſed; by taking away $\dot x$, it will be $3xx$; and by increaſing its Index by Unity, it will be $3xxx$: Then dividing it by 3, its now (augmented) Index, the Quotient will be xxx, the flowing Quantity required.

Again:

Suppoſe $\frac{n}{m}\dot x x^{\frac{n}{m}-1}$ a Fluxion propoſed: By taking away the fluxionary x, it will be $\frac{n}{m} x^{\frac{n}{m}-1}$: By augmenting the Index by Unity (*i. e.* taking away -1) it will be $\frac{n}{m}\dot x^{\frac{n}{m}}$: And laſtly, by dividing the remaining Part of the Fluxion by $\frac{n}{m}$, prefixed to, or multiplied into x, the Quotient will be $x^{\frac{n}{m}}$: Which is the flowing Quantity ſought.

You will find Examples enough of this *inverſe Method*, the *Calculus Integralis*, or *ſummatory Arithmetick*, in Mr. *Hayes*'s Book of Fluxions, *Sect.* 4.

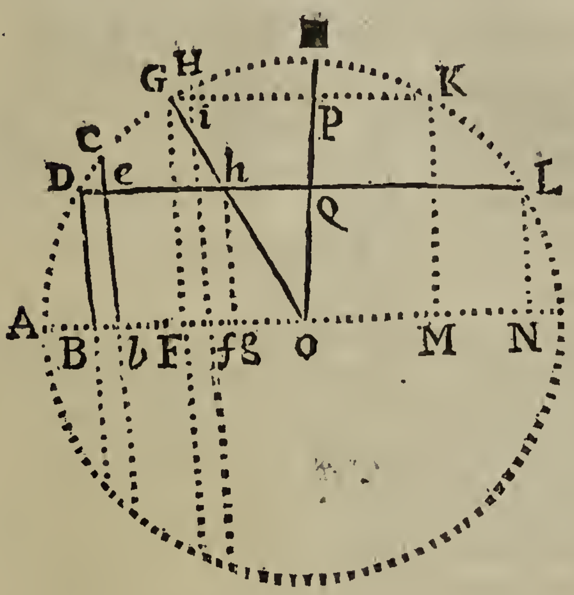
Some Inſtances of the Proportions of Fluxions in various Curves, by Mr. H. Ditton.

Let x and v expreſs Abſciſſes, y and z the correſpondent Ordinates univerſally: Then in the Circle we have $\dot y : \dot z :: \frac{r\dot x - x\dot x}{y} : \frac{r\dot v - v\dot v}{z}$: And ſuppoſing the Abſciſſe to flow uniformly, and conſequently $\dot x = \dot v$, we have $\dot y : \dot z :: rz - xz : ry - vy :: r - x : \frac{ry - vy}{z}$; *viz.* the Fluxions Ce, Hi, are to one another, as BO to GO; the Point g being ever determined by the Perpendicular bg, let fall from b the Interſection of the Radius OG, with the Line Db.

'Tis certain that $gO = \frac{ry - vy}{z}$, from the Similar Triangles GFO, bgO; for $bg = DB = y$, and $z : r - v :: y : \frac{ry - vy}{z}$.

$AC = r$

$AC = r$ $CF = z$ $Hi = \dot z$
$AB = x$ $DB = y$ $OF = u$
$AF = v$ $Ce = \dot y$ $OB = x$



In the Parabolick Curves, putting p the Parameter $= 1$, then $y = \overset{n}{x}$, and $z = \overset{n}{v}$, then $\dot y : \dot z :: n x^{n-1} \dot x : n v^{n-1} \dot v :: x^{n-1} : v^{n-1} :: y^{\frac{n-1}{n}} : z^{\frac{n-1}{}}$.

Therefore in the common Parabola, $\dot y : \dot z :: \frac{1}{y} : \frac{1}{z} :: z : y$, that is, the Fluxions of the Ordinates are reciprocally as the Ordinates.

Therefore if an Hyperboloid be form'd from the Parabola; that is, one whoſe Ordinates (to the Convex Side of the Curve, and parallel to one of the Aſymptotes) be a Series of Reciprocals to the Subſecundans; and one Aſymptote being the Axe of the Parabola, and the other the Vertical Tangent of the Parabola; then the Fluxion of the parabolical Ordinates ſhall be as the correſponding Ordinates in the Hyperboloid.

In the vulgar Cycloid, the correſponding Circular Ordinates being called s and t, from the Nature of the Cycloid $\dot y = \dot s + \dot c$, and $\dot z = \dot t + \dot C$, the Quantities c and C expreſſing the circular Arches. But from the Nature of the Circle $\dot s + \dot c = \frac{2r\dot x - x\dot x}{s}$, and $\dot t + \dot c = \frac{2r\dot v - v\dot v}{t}$, ſo that $\frac{\dot y : \dot z}{2r - v \times s} :: \frac{2r - x}{s} : \frac{2r - v}{t} :: \frac{\quad}{2r - x \times t}$.

So that the Fluxions of the Cycloidick Ordinates, are in the Ratio compounded of the Segments of the Diameter directly, and the Circular Ordinates inverſely, or as the Rectangles under thoſe Segments, and the Ordinates alternately taken.

In the Circle, putting $\dot c$, $\dot C$, the Fluxions of the Curve correſponding to the equal Fluxions of the Abſciſſes $\dot x$ and $\dot v$ we have $\dot c = \frac{r\dot x}{y}$, and $\dot C = \frac{r\dot v}{z}$; and conſequently, $\dot c : \dot C :: \frac{r}{y} : \frac{r}{z} :: z : y$; that is, the Fluxions of the Curve are reciprocally as the Ordinates.

Of the Uſe of Fluxions in finding the greateſt and leaſt Ordinates in a Curve, to which the Solution or Problems de Maximis & Minimis *may be reduced.*

Definition I.

Fig. 31, 32, 33, 34.

Let MDM be a Curve, whoſe Ordinates PM, ED, PM, are parallel to each other; and let this Curve be ſuch, that while the *Abſciſſa* P continually increaſes, the Ordinate PM increaſes likewiſe, until it comes to a certain Point E, and afterwards decreaſes until it comes to a certain Point E, and afterwards increaſes.

Then the Line ED is called the greateſt or leaſt Ordinate, or a *Maximum* or *Minimum.*

Definition II.

If a Quantity, as PM, be propoſed, conſiſting of one or more indeterminate Quantities, as AP; and while AP continually increaſes, the ſaid Quantity PM increaſes likewiſe, until it comes to a certain Point E, after which it conſtantly decreaſes, or contrariwiſe; and if it be required to find ſuch a Value or Expreſſion of AP, that the Quantity ED, of which it conſiſts, may be greater or leſs than any other Quantity, PM, formed in like manner from AP; this is called a Problem *de Maximis & Minimis.*

General Propoſition.

The nature of the Curve MDM being given, to find AE ſuch a Value of AP, that the Ordinate ED, be greater or leſſer than any other PM, of the ſame Nature.

When AP, PM increaſe together, it is evident, that RM, the Fluxions of PM, will be poſitive with regard to the Fluxion of AP; and on the contrary, if M decreaſes, while the Ordinate AP increaſes, the Fluxion of PM will be negative; now every Quantity that continually increaſes or decreaſes, cannot from being poſitive become negative, without firſt paſſing through infinity or nothing; (*viz.*) through 0 when the Quantity in the beginning conſtantly goes on decreaſing, and thro' Infinity when it continually increaſes in the beginning; therefore the Fluxion of a Quantity expreſſing a *Maximum* or *Minimum*, muſt be equal to 0, or Infinity: Now becauſe the Nature of the Curve MDM is given, we can find (by Sect. 1 or 2) a Value of RM, which being firſt made equal to 0, and afterwards to Infinity, from thence, in both the Suppoſitions, the required Value of AE, will be had

Scholium.

Fig. 31, 33.

The Tangent in D is parallel to the Axis AB, when the Fluxion RM becomes 0 in that Point: But when it becomes infinite, the Tangent coincides with the Ordinate ED. Whence we may obſerve, that the Ratio of MR to RM, (*viz.*) that of the Ordinate to the Subtangent in the Point D, is 0 or infinite. It eaſily appears that a Quantity continually decreaſing, from poſitive cannot become negative, without firſt paſſing thro' 0; but that a Quantity continually increaſing, muſt paſs thro' Infinity to become negative, does not ſo eaſily appear; and therefore to aſſiſt the Imagination, let Tangents be conceived to iſſue from the Points M, D, M. *Fig.* 31. Now in Curves, where the Tangent gent in D is parallel to the Axis AB, it is manifeſt, that the Subtangent PT increaſes ſo much the more, as the Points M and P accede to DE; and ſo when M coincides with D, the ſame becomes infinite; and when at length AB is greater than AE, the Subtangent PT, from poſitive becomes negative, or contrariwiſe.

Example I.

Fig. 35.

Let $x^3 + y^3 = axy$ (aP being $= x$, $PM = y$, $-AB = a$) expreſs the Nature of the Curve MDM; the Fluxion of the ſame will be $3xx\dot{x} + 3yy\dot{y} = ax\dot{y} + ay\dot{x}$ and the $\frac{ay\dot{x} - 3xx\dot{x}}{3yy \quad ax} = 0$, when the Point P coincides with the Point E ſought, whence we get $y = \frac{3xy}{a}$, and putting this latter part of the Equation for y, in the Equation of the Curve, $x^3 + y^3 = axy$, and there will ariſe $aE(x) = \frac{1}{3}a\sqrt[3]{2}$, being ſuch, that the Ordinate ED, will be a *Maximum*, or the greateſt of any other Ordinate PM, to the Diameter aB.

Example II.

Fig. 33.

Let $y - a = a^{\frac{1}{3}}\,\overline{x\,a -}^{\frac{2}{3}}$ expreſs the nature of the Curve MDM; this thrown into Fluxions will be $\dot{y} = \frac{2\dot{x}\sqrt[3]{a}}{-\,3\sqrt[3]{a - x}}$, which I firſt make equal to 0; but becauſe this Suppoſition gives us $-2\dot{x}\sqrt[3]{a} = 0$, from which the Value of AE cannot be known, I afterwards make $\frac{-2\dot{x}\sqrt[3]{a}}{3\sqrt[3]{a - x}}$ infinite, and ſo $3\sqrt[3]{a} - x = 0$, conſequently, $aE(x) = a$.

Example III.

Fig. 36.

Let amF be a Semicycloid, whoſe Baſe BF, is leſs than half the Circumference anB of the generating Circle, and Centre is C; it is required to find the Point E in the Diameter aB, being ſuch, that the Ordinate ED ſhall be a *Maximum*, or the greateſt poſſible.

Draw the Ordinate PM at pleaſure, interſecting the Semicircle in N; and at the Points M, N, of the Ordinate, conceive the little Triangles M, R, M; and calling the indeterminate Quantities aP, x; PN, z; the Arch AN, u; and the given Quantities ANB, A; BF, B; Ca or CNc; then from the nature of the Cycloid, $anB(a,)$ $BF(b,)$ $aN(u,)$ $NM = \frac{bu}{a}$ whence $PM = z + \frac{bu}{a}$, and the Fluxion thereof $RM = \frac{a\dot{z} + b\dot{u}}{a} = 0$, when the Point P coincides with E, the Point ſought. Now the right angled Triangles NSN, NPC, are ſimilar; for if the common Angle CNS be taken away from the right Angles CNn, PNS, the remaining Angles SNn, PNC, ſhall be equal; and therefore $CN(c) : CP(c - x) : Nn(\dot{u}) : S\,x\,(\dot{z}) = \frac{c\dot{u} - x\dot{u}}{c}$:

Whence putting this Value for z, in $a\dot{z} + b\dot{u} = 0$, and there will ariſe $\frac{ac\dot{u} - ax\dot{u} + bc\dot{u}}{c} = 0$; and ſo we get x, which in this Caſe is $aE) = c + \frac{bc}{a}$.

Therefore aſſume cE towards B; a fourth Proportional to the Semicircumference ANM; the Baſe BF; and the Radius CB, and the Point E will be that ſought.

Example IV.

Fig. 35.

To cut or divide the given right Line aB, in the Point E, ſo that the Product of the Square of aE, one of the parts into the other part, be the greateſt of any Product of the like nature.

Call the unknown Quantity AE, x; and the given Quantity AB, a; then muſt $AE \times EB = axy - x^3$ be a *Maximum*. Now a Curve MDM muſt be ſuppoſed ſuch, that the Relation of the Ordinate MP (y) to the correſpondent Abſciſs AP (x) is expreſſed by $y = \frac{axx - x^3}{aa}$, and the Point E muſt be found ſuch, that the Ordinate ED be a *Maximum*; and ſo $\dot{y} = \frac{2ax\dot{x} - 3xx\dot{x}}{aa} = 0$, from whence we get $AE(x) = \frac{2}{3}a$.

And generally if you would have $x^{m} \times \overline{a - x}^{\,n}$ (where M and N expreſs any Numbers at pleaſure) to be a *Maximum*, the Fluxion of it muſt be made equal to 0, or Infinity: Whence $m\,x^{m-1}\,\dot{x}\,x\,\overline{a - x}^{\,n} - n\,\overline{a - x}^{\,n-1}\,\dot{x}\,x\,x^{m} = 0$; which divided by $x^{m-1} - x\,\overline{a - x}^{\,n-1}\,\dot{x}$, there comes out $am - mx - nx = 0$, and $AE(x) = \frac{m}{m+n}a$: If $m = 2$, and $n = -13$, then will $AE = 2a$; and the Problem may be thus laid down. *Fig.* 37.

Continue out the given Line AB towards B, to the Point E, in ſuch manner, that the Quantity $\frac{AE}{BE}$ be a *Minimum*, and not a *Maximum*; for the Equation of the Curve MDM, will be $\frac{xx}{x - a} = y$, wherein, if we ſuppoſe $x = a$, the Ordinate PM, which becomes BC, will be $\frac{aa}{0}$; that is, infinite; and conceiving x infinite, one ſhall have $y = x$, *viz.* the Ordinate will be alſo infinite.

If $m = 1$ and $n = -2$; then will $AE = -a$: whence the Problem may be after this manner ſtated: *Fig.* 38.

Continue out the given Right-line AB towards A to the Point E, ſo that the Quantity $\frac{AE \times \overline{AB}^{2}}{BE^{2}}$ be the greateſt of any other.

the like Quantity $\frac{AP \times \overline{AB}^{2}}{\overline{BP}^{2}}$

Example V.

Fig. 39.

The Right-line AB being divided into three Parts, AC, CF, FB, to divide or cut the middle part CF, in the Point E, being ſuch, that the Ratio of the Rectangle $AE \times EB$ to the Rectangle $CE \times EF$, be leſs than any other Ratio formed in like manner.

Call the given Quantities AC, a; CF, b; CB, c; and the unknown Quantity CE, x: then will $AE = a + x$, $EB = c - x$, $EF = b - x$, and therefore the Ratio of $AE \times EB$, to $CE \times EF$, will be $\frac{ac + cx - ax - xx}{bx - xx}$, which muſt be a *Minimum*: Whence, if a Curve MDM be ſuppoſed ſuch, that the Relation of the Ordinate $PM(y)$ to the Abſciſs $CP(x,)$ be expreſſed by $y = \frac{aac + acx - aax - axx}{bx - xx}$, the Problem will be brought to this, *viz.* to find ſuch a Value CE for x, that the Ordinate ED be leſs than any other PM of like ſort; therefore throwing the ſaid Equation into Fluxions, and afterwards divided by ax, there will come out $cxx - bxx + 2acx - abc = 0$; and one Root of this Equation will ſolve the Problem.

If $c = a + b$; then will $x = \frac{1}{2}b$.

Example VI.

Fig. 40.

Of all the Cones that can be inſcribed within a given Sphere, to find that, whoſe Convex is the greateſt.

This Problem, in other Words, is to find the Point E in AB, the Diameter of the Semicircle AFB, ſuch, that drawing the Perpendicular EF, and joyning AF, the Rectangle, $(AN \times NP)$ like it; for if the Semicircle AFB, be conceived to make an entire Revolution about the Diameter AB, it is evident, that it ſhall deſcribe a Sphere; and the right angled Triangles, AEF, APN, will generate Cones inſcribed in the Sphere; the convex Surfaces of which, deſcribed by the Chords, AE, AN, will be to one another as the Rectangles $AF \times FE$, $AN \times NP$.

Now, let the unknown Quantity $AE = x$, and the given one $AB = a$; then from the nature of the Circle, $AF = \sqrt{ax}$, $EF = \sqrt{ax - xx}$, and therefore $aF \times FE = \sqrt{aaxx - ax^3}$, which muſt be a *Maximum*; whence we muſt conceive a Curve MDM to be ſuch, that the relation of the Ordinate $PM(y)$ to the correſpondent Abſciſs $AP(x,)$ is expreſſed by $\frac{\sqrt{aaxx - ax^3}}{a} = y$; and find the Point E ſo, that the Ordinate ED, be greater than any other (PM) of like ſort; and making the Fluxion of the Equation $\frac{2az\dot{x} - 3xx\dot{x}}{2\sqrt{aaxx \quad ax^3}}, = 0$, we get $AE\ (x) = \frac{2}{3}a$.

Example VII.

Among all the Parallelopipedons equal to a given Cube a^3, and having the given Right Line b for one of the Sides, to find that which has the leaſt Superficies.

Call one of the two Sides ſought x, and the other will be $\frac{a^3}{bx}$; then aſſuming the alternate Planes $b, x, \frac{a^3}{bx}$, of the Parallelopipedon, and their Sum, *viz.* $b + x + \frac{a^3}{x}\frac{a^3}{b}$, will be half of the Superficies, which muſt be a *minimum*; and ſo (as all along) conceiving a Curve expreſſed by $\frac{bx}{a} + \frac{aa}{x} + \frac{aa}{b} = y$, the Fluxion of this Equation muſt be equal to 0; that is, $\frac{b\dot{x}}{a} = \frac{aa\dot{x}}{xx} = 0$; from whence there comes out $xx = \frac{a^3}{b}$, and $x = \sqrt{\frac{a^3}{b}}$; conſequently the three Sides of the Parallelopipedon required, will be $b\sqrt{\frac{a^3}{b}}$, and $\sqrt{\frac{a^3}{b}}$: Whence you may obſerve, that two Sides are equal.

Example VIII.

Fig. 41.

Among all the Parallelopipedons that are equal to a given Cube a^3, to find that which has the leaſt Superficies.

Call one of the unknown Sides x; then by the laſt Example it is plain, that the two other Sides will be each equal to $\sqrt{\frac{a^3}{b}}$; and therefore the Sum of the alternate Planes will be $\frac{a^3}{x} + 2\sqrt{a^3 x}$, which muſt be a *Minimum*, whence the Fluxion of this muſt be equal to 0, *viz.* $\frac{a^3\dot{x}}{xx} + \frac{a^3\dot{x}}{\sqrt{a^3 x}} = 0$ and ſo $x = a$; and conſequently the two Sides ſhall alſo be equal to a; ſo that the Cube it ſelf ſolves the Problem.

Example IX.

Fig. 41.

The Line AEB being given in Poſition on a Plane, together with two ſtable Points, C, F; and if two Right Lines $CP\ (u,)$ $PF\ (z,)$ be drawn from any Point P, in it; and if a Quantity be made up of theſe indeterminate ones u and z, and other given Right Lines a, b, &c. at pleaſure; it is required to find ſuch a Poſition of the Right Lines CE, EF, that the Quantity given, which is made up of them, be greater or leſſer than that ſame Quantity when it is made of the Right Lines CP, PE.

Let us ſuppoſe the Lines CE, EF, to have the requiſite Situation: Join CF, and conceive the Curve DM to be ſuch, that drawing PQM at pleaſure, perpendicular to CF, the Ordinate QM may expreſs the Quantity given. Now it is manifeſt, that when the Point P falls in the Point E, the Ordinate QM, which then becomes OD, muſt be the greateſt or leaſt of all others of the like ſort; therefore the Fluxion of it muſt be equal to 0, or infinite; whence if the given Quantity, for Example, is $au \times zz$; then will $a\dot{u} \times 2z\dot{z} = 0$; and conſequently, $\dot{u} : -\dot{z} :: 2z : a$. Wherefore we may already perceive that $\dot{z}$ muſt be negative with reſpect to u; that is, the Right-lines CE, EF, muſt have ſuch a Poſition that z decreaſes, at the ſame time as u increaſes.

Now if EG be drawn perpendicular to the Line AEB, and from any Point G therein, the Lines GL, GI, be likewiſe drawn perpendicular to CE, EF, and the Right-lines CKe, FeH, be drawn from the Point e infinitely near E, and from the Centres e, F, be deſcribed the ſmall Arches EK, EH, the right angled Triangles ELG, and EKe, EIG, and EHF, will be ſimilar; for if the Angle LEe, be taken from the right Angles GEe, LEK, the remaining Angles LEG,

KBe, ſhall be equal: Whence $GL : GI :: KB(\dot{u}) : He - (\dot{z}) :: 2z : a$. Therefore the Poſition of the Right Lines CE, EF, muſt be ſuch, that when EG is drawn perpendicular to the Line AEB, the Sine (GL) of the Angle GEC, is to the Sine (GI) of the Angle GEF, as the Quantities drawn into $\dot{z}$, to the Quantities drawn into $\dot{u}$, which was to be found.

COROL.

Fig. 42.

If the Right Line CE be given, both in Poſition and Magnitude, and EF only in Magnitude; and the Poſition thereof be required; it is evident, that the Angle GEC being given, its Sine (GL) will be given likewiſe, and conſequently, the Sine (GI) of the Angle (GEF) ſought; therefore if a Circle be deſcribed with EG as a Diameter, and the Value of GI be laid off in the Circumference from G to I; and the right Line EF paſſing thro' the Point I, will have the requiſite Poſition.

Let $au + bz$ be the Quantity given; then will GI be $= \frac{a \times GL}{b}$: And ſo it appears, that let EC and EF have what length ſoever, the Poſition of this latter ſhall be always the ſame, ſince they do not come into the Value GI, which conſequently does not vary. If $a = b$, it is plain, that the Poſition of EF muſt be in CE continued out from E, becauſe $GL = GI$, when the Points G and F fall on each Side the Line AB: But when they fall on the ſame Side, the Angle FEG muſt be aſſumed equal to the Angle CEG.

Example X.

Fig. 42.

The Circle AEB being given in Poſition, as alſo the Points C and F without the ſame; to find the Point E in the Periphery, being ſuch, that the Sum of the Right Lines CE, EF, may be a *Minimum.*

Suppoſe the Point E to be that ſought, and draw the Line OEG for the Centre O; which will be perpendicular to the Circumference AEB; and ſo the Angles FEG, CEG, will be equal. Therefore if EH be drawn ſo, that the Angle EHO be equal to the Angle CEO, and likewiſe EK, ſo that the Angle EKO be equal to the Angle FEO, and the Parallels ED, EL, to OF, OC; and there will be formed the ſimilar Triangles OCE and OEH, OFE and OEK, HDE and KLE; and calling the known Quantities OE, OA or OB, a; OC, b; OF, c; and the unknown ones OD or LE, x; DE or OL, y; then will $OH = \frac{aa}{b}$, $OK = \frac{aa}{c}$, and $HD\left(x - \frac{aa}{b}\right) : DE(y) :: KL\left(y - \frac{aa}{c}\right) : LE(x)$: Whence $xx - \frac{aax}{b} = yy - \frac{aay}{c}$. And this is an Equation appertaining to an *Hyperbola*, which may be eaſily conſtructed, and will cut the Circle in the Point E ſought.

Example XI.

Fig. 43.

A Traveller ſetting out from a Place C, to go to a Place F, muſt croſs the Countries, divided from each other by the Right Line AEB. Now ſuppoſe him to go the length A in the time C, in the Country adjoining to C; and the length b in the ſame time c, in the other Country adjoining to F; it is required, to find the Point E in the Right Line AEB, thro' which he is to paſs in the ſhorteſt time poſſible, from C to F.

Make $a : CE(u) :: c : \frac{cu}{a}$; and $b : EF(z) :: c : \frac{cz}{b}$; then it is plain, that $\frac{cu}{a}$ expreſſes the time of the Traveller's going the length CE; and $\frac{cz}{b}$ the time of his going the length EF; ſo that $\frac{cu}{a} + \frac{cz}{c}$, muſt be a *maximum*: Whence drawing EG perpendicular to AB, the Sine of the Angle GEC, muſt be to the Sine of the Angle GEF, as a to b.

This being premiſed, if the Circle CGH, be deſcribed with the Radius EC, from the Point ſought E, as a Centre; and the Perpendiculars, CA, HD, FB, be drawn to the Right Line AEB; and the Perpendiculars GL, GI, to the Right Lines CE, EF; we ſhall have, $a : b :: GL : GI$; but $GL = AE$, and $GI = ED$, becauſe the right angled Triangles GEL and ECA, GEI and EHD, are equal and ſimilar, as may be eaſily proved: Therefore if the unknown Line AE be called x, we ſhall have $ED = \frac{bx}{a}$; and calling the known Lines AB, f; AC, AC, q; BF, b; from the Similarity of the Triangles EBF, EDH, $EB(f - x) : BF(b) :: ED\left(\frac{bx}{a}\right) : DH = \frac{bbx}{af - ax}$: But becauſe of the right angled Triangles EDH, EAC, of equal *Hypothenuſes* EH, EC, $\overline{ED}^2 + \overline{DH}^2$ will be $= \overline{EA}^2 + \overline{AC}^2$; that is, $\frac{bbxx}{aa} + \frac{bbbbxx}{aaff - 2aafx + aaxx} = xx + gg$: and freeing the Equation from Fractions, and afterwards duly ordering the ſame, there will ariſe,

$$\begin{aligned} &aax^4 - 2aafx^3 + aaffxx - 2aafggx + aaffgg \\ &= 0 - bb + 2bbf + aagg \\ &\qquad\qquad\qquad - bbff \\ &\qquad\qquad\qquad - bbbb. \end{aligned}$$

This Equation may be gotten after the following manner, without having recourſe to the ninth Example.

Having named the known Lines, as before, *viz.* AB, f; AC, g; BF, b; and the unknown one AE, x, make $a : CE(\sqrt{gg + xx}) :: c : \frac{c\sqrt{gg + xx}}{a} =$ to the time the Traveller is going the length CE; and in like manner, $b : EF(\sqrt{ff - 2fx + xx + bb} :: c : \frac{c\sqrt{ff - 2fx + x + bb}}{b} =$ time of his going the Length EF: So that $\frac{c\sqrt{gg + xx}}{} + \frac{c\sqrt{ff - 2fx + x + bb}}{b} =$ a *minimum*; and therefore $\frac{cx\dot{x}}{a\sqrt{gg + xx}} + \frac{cx\dot{x} \quad cf\dot{x}}{b\sqrt{ff - 2fx + xx + bb}} = 0$: Whence dividing by $c\dot{x}$, and freeing the Equation from Surds, we ſhall have the ſame Equation as before; one Root of which, will expreſs AE, the *minimum* ſought.

Example XII.

Fig. 44.

Let F be a Pulley, hanging freely from the End of a Cord CF, faſtned in C; and let D be a Weight ſuſpended by the Cord DFB, put over the Pulley *F*, which Cord is faſtened in *B*; ſo that the Points *C* and *B*, lie in the ſame Horizontal Line *CB*. Now if the Cords and Pulley be ſuppoſed to have no Weight, it is required, to find in what Place the Weight *D*, of Pulley *F*, will ſettle or come to reſt.

By the Principles of Mechanicks, it is plain, that the Weight *D* will deſcend as far as poſſible below the Horizontal Line *C B*: Therefore the Plumb Line *D E F*, will be a *Maximum*. And therefore calling the given Quantities *C F*, a; *D F B*, b; *C B*, c; and the unknown Quantity *C E*, x; there will ariſe $EF = \sqrt{aa-xx}$, $TB = \sqrt{aa+cc-2cx}$, and $DFE = b - \sqrt{aa+cc-2cx} + \sqrt{aa-xx}$, which muſt be a *Maximum*, and ſo the Fluxion of it will be $\frac{c\dot{x}}{\sqrt{aa+cc-2cx}} - \frac{x\dot{x}}{\sqrt{aa-xx}} = 0$; whence that ariſes $2cx^3 - 2ccxx - aaxx + aacc = 0$: And dividing by $x-c$, there comes out $2cxx - aax - aac = 0$; one Root of which will expreſs *C E* ſuch, that the Perpendicular *E D* paſſes by the Pulley *F*, and the Centre *D* of the Weight, when the ſame is at reſt.

Here follows another Solution of this Problem.

Call *E F*, y; *B F*, z; then will $b - z + y =$ *Maximum*, and ſo $\dot{y} = \dot{z}$. Now it is evident that the Pulley *F* does deſcribe *C F A* about the Point *C* as a Centre: And if *F R* be drawn from the Point *F*, infinitely near to *E*, parallel to *CB*, and *FS* perpendicular to *B E*; therefore will $FR = \dot{y}$, and $FS = \dot{z}$; which are conſequently equal to each other: And ſo the little right angled Triangles *F R f*, *F S f*, having the common Hypothenuſe *Ff*, are equal and ſimilar: Whence the Angle *R F f* is equal to the Angle *S F f*; that is, the Point *F* muſt be ſo ſituate in the Periphery *F A*, that the Angles made by the Right Lines *E T*, *F B*, with the Tangents in *F*, be equal to each other: Or elſe (which comes to the ſame) the Angles *B F C*, *D F C*, equal.

This being premiſed, if you draw *F H*, ſo that the Angle *F H C* be equal to the Angle *C F B*, or *C F D*; as alſo the right angled Triangles *E C F*, *E F H*; ſince the Angle *C F E* is equal to the Angle *F H E*, each of them being the Complement of the equal Angles *F H C*, *C F D*, to two Right Angles; and conſequently $CH = \frac{aa}{c}$, and $HE \left(x - \frac{aa}{c}\right) : EF(y) : EF(y) :: EC(x)$. Whence $xx - \frac{aax}{c} = yy = aa - xx$ from the nature of the Circle: from whence ariſes the ſame Equation as at firſt.

Example XIII.

Fig. 45.

The Elevation of the Pole being given: To find the Day of the Year wherein the Twilight will be the ſhorteſt poſſible.

Let *C* be the Centre of the Sphere; *A P T O B H Q* the Meridian; *H D d O* the Horizon; *Q E e T* the Crepuſcular Circle, parallel to the Horizon; *A M N B* the Equator; *F E D G* that part of the Parallel to the Equator, (the Sun deſcribes the Day wherein the Twilight is ſhorteſt) contained between the Planes of the Horizon and the Crepuſcular Circle; *P* the South Pole; *P E M*, *P D M*, Quadrants of Circles of Declination. Now the Arch *H Q*, or *O T*, of the Meridian, comprehended between the Horizon and the Crepuſcular Circle; and the Arch *O P*, of the Elevation of the Pole, are given; and conſequently their Sines, *C I*, or *F L*, or *Q X*, and *O U*: Now we muſt find *C K*, the Sine of the Arch *E M* or *D N*, of the Sun's Declination, when he deſcribes the Parallel *E D*.

If you ſuppoſe another Part *f e d g*, of a Parallel to the Equator infinitely near to *E F D G*, and draw the Quadrants *P e M*, it is manifeſt, that the Time the Sun takes up in deſcribing the Arch *E D*, muſt be a *Minimum*; and the Fluxion of the Arch *M N*, being the Meaſure of it, and becoming *m n* when *E D* becomes *e d*, muſt be equal to nothing: Whence the ſmall Arches *M m*, *N n*, and conſequently the little Arches *R e*, *S d*, will be equal to each other. Now the Arches *R E*, *S D*, being contained between the ſame Parallels *E D*, *e d*, are equal likewiſe; and the Angles at *S* and *R* are right ones. Therefore the little right-angled Triangles *E R e*, *D S d* (conſidered as right-lined Triangles, on account of their Sides being infinitely ſmall) will be equal and ſimilar; and conſequently the Hypothenuſes *E e*, *D d* ſhall be equal likewiſe.

This being premiſed, the Right-lines *D C*, *E F*, *d g*, *e f*, the common Sections of the Planes *F E D G*, *f e d g*, parallel to the Equator; and the Horizon and Crepuſcular Circle, will be perpendicular to the Diameters *H O*, *Q T*; becauſe the Planes of all theſe Circles are perpendicular to the Plane of the Meridian; and the little Right Lines, *G g*, *f g*, are parallel. Therefore $\sqrt{\overline{Dd}^2 - \overline{Gg}^2}$, or $DG - dg = \sqrt{\overline{Ee}^2 - \overline{Ff}^2}$; or $fe - FE$. Now it is plain, (from *Art.* 50) if two Ordinates in a Semicircle be drawn infinitely near, the ſmall Arch intercepted between them will be to their Fluxion, as the Radius is to the part of the Diameter intercepted by the Centre and thoſe Ordinates. Whence (becauſe of the Circles *H D O*, *Q E T*) $CO : CG :: Dd$, or $Ee : DG - dg$, or $fe - FE :: IQ : IF :: CO + IQ$, or $OX : CG + IF$, or GL. But becauſe of the right-angled ſimilar Triangles *C U O*, *C K G*, *F L G*: therefore $CO : CG :: OU : GK$. And $GK : GL :: CK : FL$, or QX: Whence $OU : CK :: OX : XQ :: XQ : XH ::$ by the nature of the Circle: That is, if *Q X* be taken for the Radius in the right-angled Triangle *Q X H*, and the Angle *H Q X* be 9 Degrees, (becauſe the Arch *H Q* by Aſtronomers is ſuppoſed to be 18 Degrees) and you make as the Radius is to the Tangent of an Angle of 9 Degrees, ſo is the Sine of the Elevation of the Pole to a fourth Sine; this will be the Sine of the Sun's Southern Declination that Day of the Year the Twilight is the ſhorteſt poſſible. So that if you take 0.8002875 from the Logarithm of the Sine of the Elevation of the Pole, the Remainder will be the Logarithm of the Sine ſought.

FLUXUS *Chyloſus*, the ſame with *Cœliaca paſſio*.

FLUXUS *Hepaticus*, is a kind of Dyſentery, wherein black ſhining Blood, and much over-heated and torrified, as it were, is driven out of the Guts by the Fundament. It is ſometimes taken for a Dyſentery, wherein ſerous ſharp Blood is evacuated. *Blanchard.*

FLY: See *Flie.*

FLYBOAT, is a large Veſſel with a broad Bow; uſed by Merchants in the Coaſting Trade. Some of theſe will carry 800 Tun of Goods.

FLYERS, is the Workmens Term in Architecture for Stairs that go ſtrait, and don't wind round; nor are the Steps tapering, but the fore and back Part of each Stair and the Ends are reſpectively parallel to one another. So that if one Flight don't carry you to your deſign'd Height, there is a broad half Space; and then you fly again with Steps every where of the ſame Breadth and Length, as before.

FLYING *Bridges*, [in *Fortification*,] are made of two ſmall Bridges laid one upon the other, ſo that the uppermoſt, by the means of Ropes and Pullies, is forc'd forwards 'till the End of it join to the Place deſign'd.

FLYING-CAMP, is a ſmall Body of an Army, conſiſting of 4, 5, or 6000 Men, and ſometimes of a greater Number, as well Foot as Horſe, which continually keeps the Field, making divers Motions to prevent the Incurſions of the Enemies, or to fruſtrate their Enterprizes; to hinder Convoys, to haraſs the adjacent Country, and to throw it ſelf, as occaſion ſerves, into any beſieged Place.

FLYING-PINION, is a Part of a Clock, having a Fly or Fan, thereby to gather Air, and ſo to bridle the Rapidity of the Clock's Motion, when the Weight deſcends in the ſtriking Part.

FOCILE *Majus*, is the greater Bone of the Cubit called *Ulna*; or the leſſer Bone of the Leg, called *Fibula*. L.

FOCILE *Minus*, is the leſſer Bone of the Cubit, called *Radius*; or the leſſer Bone of the Leg, called *Tibia*. L.

FOCUS, is with ſome a Place in the Myſentery, or other Parts, whence they formerly deduced the Original of Fevers. *L.*

FOCUS of an *Ellipſis*, is a Point towards each End of the longer Axis; from whence two Right Lines being drawn to any Point in the Circumference, ſhall be together equal to that longer Axis. See *Ellipſis*.

FOCUS of a *Parabola*, is a Point in the Axis within the Figure, and diſtant from the Vertex by a fourth Part of the *Parameter* or *Latus Rectum*. To find it, ſee *Parabola*, *Conſectary* 5.

It is called the *Focus*, becauſe it is the Point where the Sun's Rays will be united, when reflected from a *Parabolick Concave*, and conſequently will there burn Bodies; and hence by ſome it is called the *Burning Point*. See more under *Parabola*.

FOCUS, [in *Opticks*,] or the *Focus* of a Glaſs, is the Point of Convergence or Concourſe, where the Rays meet and croſs the Axis after their Refraction by the Glaſs.

How to find this Point or Focus, Mr. *Molyneux*, in his Excellent *Dioptrica Nova*, gives ſeveral demonſtrative Ways, *Pag.* 10, 11, 12, &c. As,

1. If there be a Body of Glaſs, whoſe Surface is Convex, or the Segment of a Sphere, the Focus will be diſtant from the Pole or Vertex of the Glaſs almoſt a Diameter and half of the Convexity.

2. In a Plano-Convex Glaſs, the parallel Rays are united with the Axis; or its Focus is from the Pole of the Glaſs at the Diſtance of a Diameter of the Convexity, if the Segment be but of 30 Degrees.

In a Plano-Convex Glaſs, As 107 : 193 : : So is the Radius of the Convexity : to the refracted Ray taken in its Concourſe with the Axis; which in Glaſſes of large Spheres, is almoſt equal to the Diſtance of the Focus taken in the Axis.

3. In double Convex Glaſſes of the ſame Sphere, the Focus is diſtant from the Pole of the Glaſs about the Radius of the Convexity, if the Segment be but 30 Degrees.

But if the Convexities are unequal, or if the two Sides are Segments of different Spheres;

Then the Rule is,
As the Sum of the Radii of both Convexities :
To the Radius of either Convexity alone : :
So is the double Radius of the other Convexity :
To the Diſtance of the Focus.

N. B. The Rays which fall near the Axis of any Glaſs, are not united with it ſo ſoon as thoſe which are farther off: Nor will the Focal Diſtance be ſo great in a Plano-Convex Glaſs, when the Convex Side is towards the Object, as on the contrary. Wherefore that Learned Gentleman concludes truly, That in viewing any Object by a Plano-Convex Glaſs, the Convex Side ſhould be turned outward: As alſo in burning by ſuch a Glaſs, *P.* 25.

FOCUS. Dr. *Hook*, *Op. Poſthum. p.* 122, very well accounts for the Reaſon of the great Effect of Burning-Glaſſes, thus: Suppoſe there be one, either Concave or Convex, of a Foot in Diameter; this will conſtipate or crowd together all the Rays of the Sun, which fell before on the Area of a Circle 12 Inches in Diameter, into the compaſs of $\frac{1}{8}$ of an Inch. The Area's then of the two Circles will be as 9216 to 1; and conſequently, the Heat of the Leſſer, to the Heat of the Greater, will be reciprocally as 9216 to 1: That is, the Heat in the Focus will exceed the Sun's common Heat at that time 9216 Times. And this will have an Effect, as great as the direct Rays of the Sun would have on a Body plac'd at one 96th Part of the Diſtance of the Earth from the Sun; or on a Planet that ſhould move round the Sun, at but a very little more than a Diameter of the Sun's Diſtance from him; or that would never appear further from him than about 36 Minutes. *L.*

FOCUS *Virtual*: See *Virtual Focus*.

1. In Concave Glaſſes, when a Ray falls from Air parallel to the Axis, the *Virtual Focus*, by its firſt Refraction, is at the Diſtance of a Diameter and an half of the Concavity.

2. In Plano-Concave Glaſſes, when the Rays fall parallel to the Axis, the *Virtual Focus* is diſtant from the Glaſs the Diameter of the Concavity.

3. In Plano-Concave Glaſſes, As 107 : 193 : :
So the Radius of the Concavity :
To the Diſtance of the *Virtual Focus*.

4. In double Concaves of the ſame Sphere, parallel Rays have their *Virtual Focus* at the Diſtance of the Radius of the Concavity.

But whether the Concavities be equal or unequal, the *Virtual Focus*, or *Point of Divergency* of the parallel Rays, is determined by this Rule:

As the Sum of the Radii of both Concavities:
Is to the Radius of either Concavity : :
So is the double Radius of t'other Concavity :
To the Diſtance of the *Virtual Focus*.

5. In Concave Glaſſes, if the Point to which the incident Ray Converges, be diſtant from the Glaſs farther than the *Virtual Focus* of parallel Rays; the Rule for finding the *Virtual Focus* of this Ray is this:

As the difference between the Diſtance of this Point from the Glaſs, and the Diſtance of the *Virtual Focus* from the Glaſs:
Is to the Diſtance of the *Virtual Focus* ::
So the Diſtance of this Point of Convergence from the Glaſs:
To the Diſtance of the *Virtual Focus* of this Converging Ray.

6. In Concave Glaſſes, if the Point to which the incident Ray Converges, be nigher to the Glaſs than the Virtual Focus of parallel Rays; the Rule to find where it croſſes the Axis is this:

As the Exceſs of the Virtual Focus more than this Point of Convergency: Is to the Virtual Focus::
So the Diſtance of this Point of Convergency from the Glaſs:
To the Diſtance of the Point where this Ray croſſes the Axis.

7. To find the Focus of a Meniſcus Glaſs; ſee under the Word *Meniſcus*.

Practical Rules for finding the Foci *of Glaſſes.*

For Convex *Spherick Glaſſes.*

1. For Glaſſes of ſmall Spheres, (that is, of deep Convexities) apply them to the End of a Scale of Inches and Decimal Parts, and expoſe them before the Sun; and upon the Scale we ſhall find the bright Interſection of the Rays exactly meaſured out; or expoſe them in the Hole of a dark Chamber, and where a white Paper receives the diſtinct Repreſentation of diſtant Objects, there is the Focus of this Glaſs. This is an univerſal and certain way for all Convexes.

For a Glaſs of a pretty long Focus, obſerve ſome diſtant Objects through it, and recede from the Glaſs till the Eye perceives all in Confuſion, or till the Objects begin to appear inverted; here the Eye is in the Focus.

If it be a Plano-Convex Glaſs, make it reflect the Sun againſt a Wall; we ſhall on the Wall perceive two ſorts of Light; one more bright, within another more obſcure; withdraw the Glaſſes from the Wall till the bright Image is at its ſmalleſt, the Glaſs is then diſtant from the Wall about the fourth Part of its focal Length.

If it be a double Convex, expoſe each Side to the Sun in like manner, and obſerve both the Diſtances of the Glaſs from the Wall. The firſt Diſtance is about half the Radius of the Convexity turned from the Sun; and the ſecond Diſtance is about half the Radius of t'other Convexity likewiſe: Thus we have the Radii of the two Convexities; whence the Focus is found by this Rule:

As the Sum of the Radii of both Convexity:
To the Radius of either Convexity::
So is the double Radius of the other Convexity:
To the Diſtance of the Focus.

The Foci of Concaves are obtain'd by Reflection; for as a *Concave Mirror*, or *Speculum*, burns at the Diſtance of about half the Radius of the Concavity; ſo a *Concave Glaſs*, being ſuppoſed a *Reflecting Speculum*, ſhall unite the Rays of the Sun at the Diſtance of about half the Radius of the Concavity.

Mr. *Halley*'s Doctrine of the Foci of ſpherical Glaſſes of all ſorts, expoſed either to diverging, converging, or parallel Rays, is as follows: See Appendix to *Molyneux*'s Dioptricks.

PROPOSITION.

To find the Focus *of any Parcel of Rays* diverging *from, or* converging to, *a given Point in the* Axis *of a* ſpherical Lens, *and inclined thereto under the ſame Angle, the* Ratio *of the Sines in Refraction being known.*

Let *G L* be the *Lens.*
P any Point in its Surface.
V the Pole thereof.
C the Center of the Sphere whereof it is a Segment.
O the Object or Point in the Axis, to or from which the Rays do proceed.
O P a given Ray.

Let the *Ratio* of Refraction be as *r* to *s*: Make *C R* to *CO*, as *s* to *r*, for the Immerſion of a Ray; or as *r* to *s* for the Emerſion; (that is, as the Sines of the Angles in the Medium which the Ray enters, to their correſponding Sines in the Medium out of which it comes.)

And laying *C R* from *C* towards *O* the Point *R* ſhall be the ſame for all the Rays of the Point *O*.

Then draw the Radius *PC*, if need be, continued; and with the Centre *R*, and Diſtance *O P*, ſweep a touch of an Arch interſecting *P C* in *Q*: The Line *Q R* being drawn, ſhall be parallel to the refracted Ray; and *P F* being made parallel thereto, ſhall interſect the Axis in the Point *F*, which is the Focus ſought.

Or make it, As $CQ : CP :: CR : CF$, and *C F* ſhall be the Diſtance of the Focus from the Centre of the Sphere.

Demonſtration.

Let fall the Perpendiculars *P x* on the Axis, *C y* on the given Ray, and *C z* on the refracted Ray.

Then *P F* and *Q R* are parallel by Conſtruction, whence the Triangle *Q R C* and *P F C* are ſimilar.

And $CR : QR :: CF : PF$;
That is, $CR : OP :: CF : PF$.
Now $CF : PF :: Cz : Px$ *ob ſim. Tri.*]
Whence $CR : OP :: Cz : Px$
And $CR : Cz :: OP : Px$

Again, $CR : CO ::$ As the Sines of Refraction, by Conſtruction; that is, as *s* to *r*, or *r* to *s*; and as $CR : Cz :: CO = \frac{r}{s}$, or $\frac{s}{r} CR : \frac{r}{s}$ or $\frac{s}{r} Cz$,
$:: PO : Px$.
But $PO : Px :: CO : Cy$,
Therefore $Cy = \frac{r}{s}$ or $\frac{s}{r} Cz$;
That is, $Cy : Cz ::$ As the Sines of Refraction;

But $\left\{\begin{matrix}Cy\\Cz\end{matrix}\right\}$ is the Sine of the $\left\{\begin{matrix}\text{Angle of Incidence}\\\text{Refracted Angle.}\end{matrix}\right.$

Q. E. D.

The ſeveral Caſes of Rays diverging or converging, as they enter the Curve Surface of a Convex or Concave *Lens*, are for the Reader's Eaſe delineated in *Fig.* 1, 2, 3, 4: And the like Caſes of emerging Rays, in *Fig.* 5, 6, 7, 8.

Fig. 1.

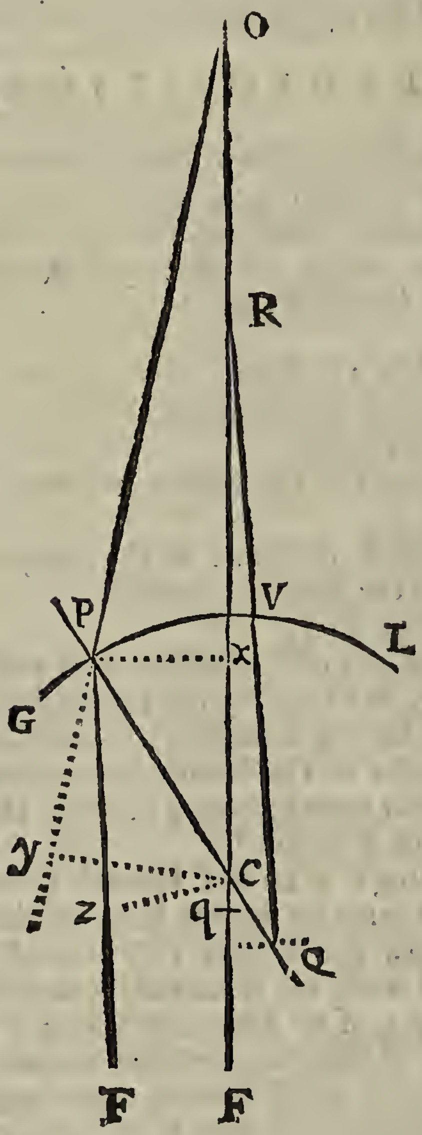


Fig. 2.

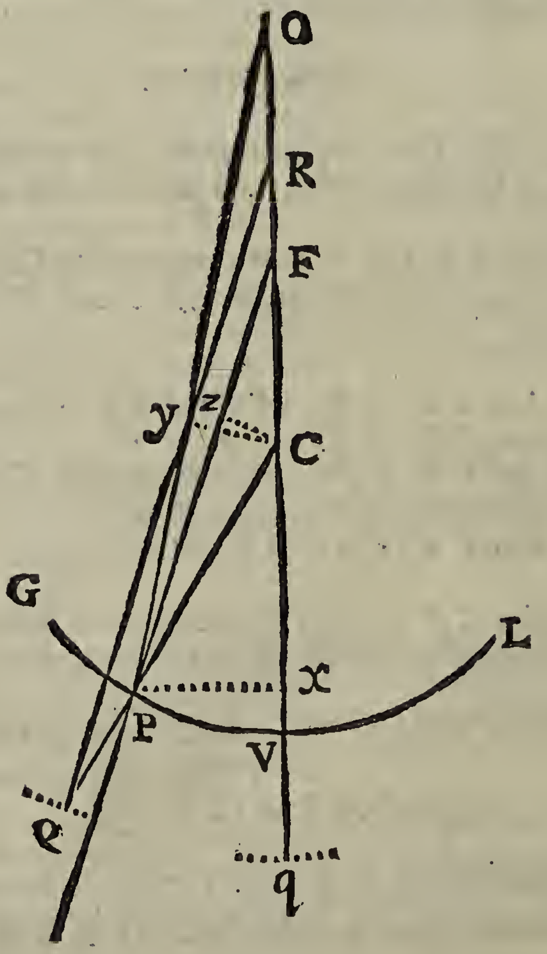


Fig. 3.

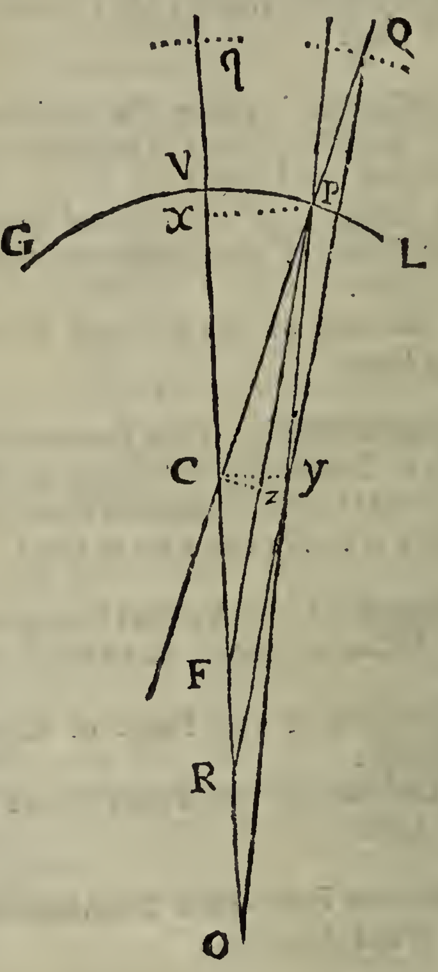


Fig. 4.

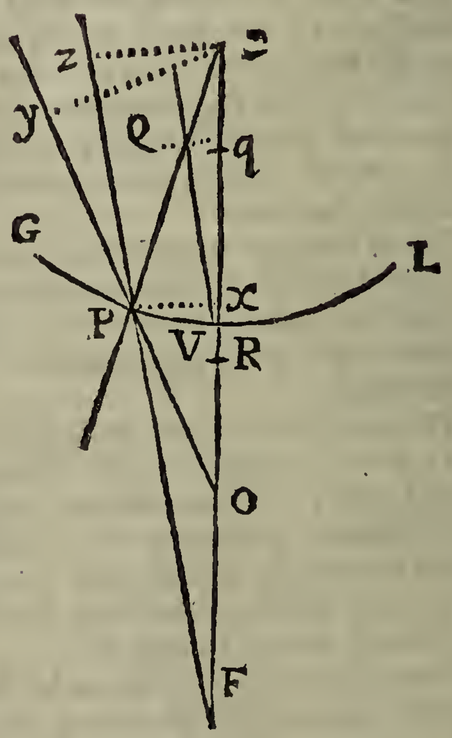


Fig. 5.

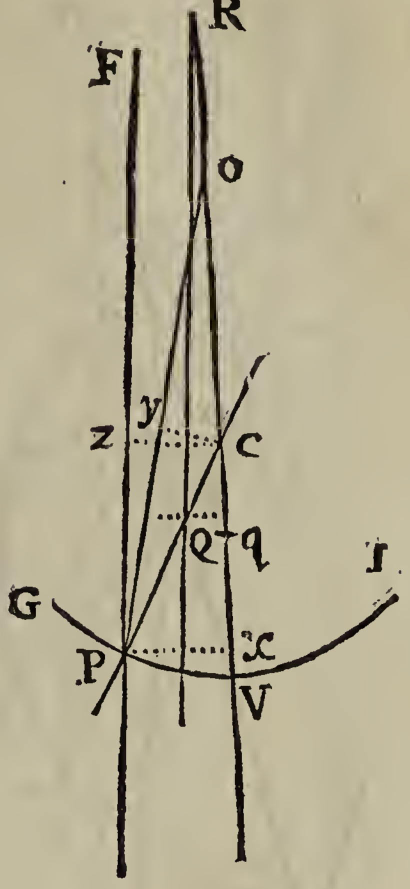


Fig. 6.

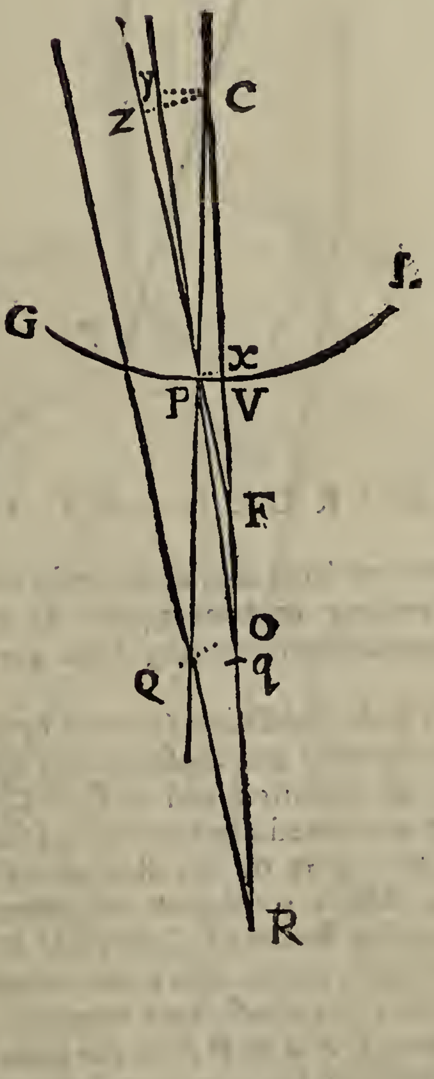


Fig. 7.

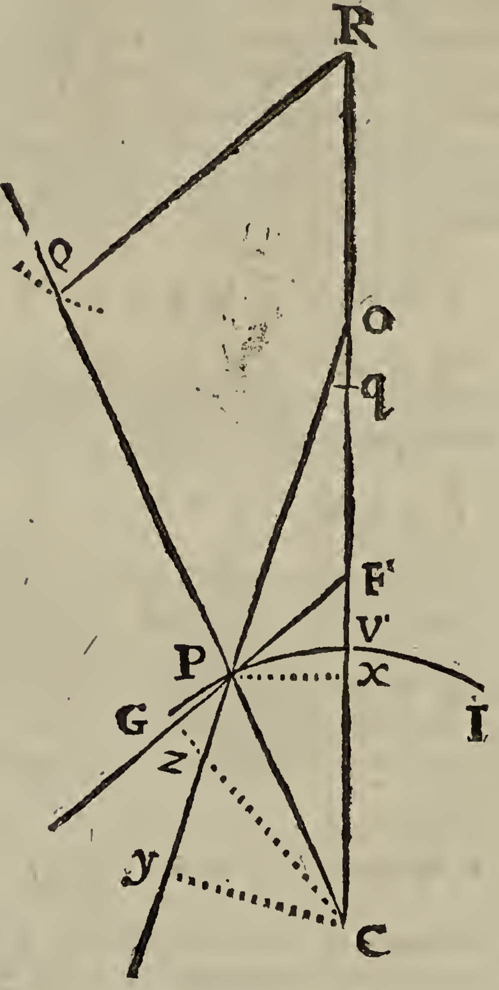
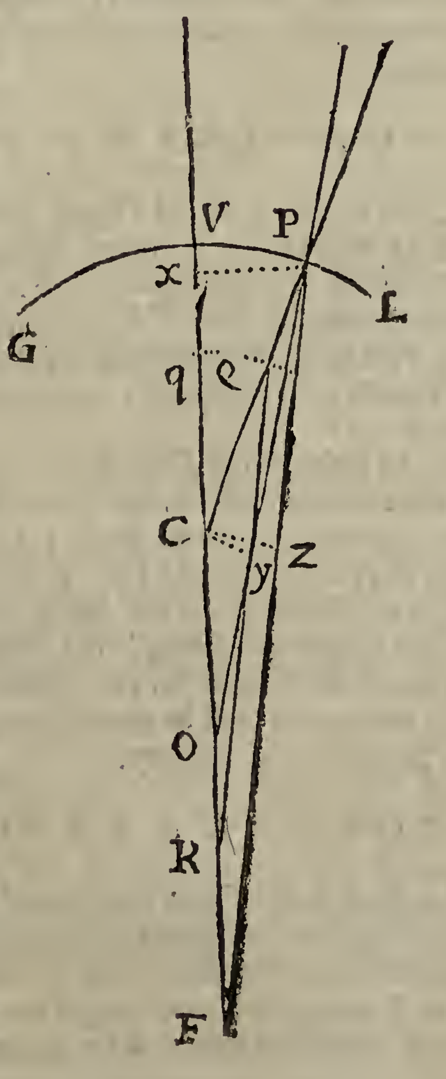


Fig. 8.



All which are drawn with the ſame Letters to their reſpective Points, only in ſome the Point *F* falling far diſtant, is to be underſtood in the Interſection of the Line *P F* with the Axis.

This thus demonſtrated, in the moſt difficult Caſes will give all the Rules for the Foci of Rays parallel to the Axis, as likewiſe for the principal Focus, where the Rays neareſt the Axis do unite: All which Rules are collected in theſe following *Corollaries*.

COROLLARY I.

If *O P* be equal to *C R*, then the Points *Q* and *C* are coincident, and the Rays *O P*, after Refraction, run on parallel to the Axis.

COROLLARY II.

If the Point *Q* fall on the ſame Side of the Axis, as is the Point *P*, then the Beams after Refraction do tend on, either diverging or converging, as before: But if *Q* fall on the other Side the Axis, as in *Fig.* 1. the diverging Rays are made to converge by a *Convex*, or the Converging to diverge by a *Concave Glaſs*.

COROLLARY. III.

If *O P* do exceed *C R*, the Focus is in all Caſes on the ſame Side of the Glaſs as is the Center of the Sphere *C*.

But contrariwiſe, if *O P* be leſs than *C R*, the Focus falls on the other Side of the Glaſs beyond the Vertex *V*.

COROLLARY. IV.

An Object may be ſo placed, that the Rays next the Axis of a *Convex Glaſs* ſhall have an imaginary Focus tranſmitting diverging Rays, when the more remote Parts thereof ſhall make them converge to a real Focus.

COROLLARY V.

If *O V*, the Diſtance of the Object from the Pole or Vertex of the Glaſs, be taken inſtead of *O P*, then will *C Q* be the difference of *O V* and *C R*; and as that difference is to *C R*, ſo is the Radius *C V*, to *C F*, the Diſtance of the principal Focus from the Center of the Sphere, whereof the Glaſs is a Segment.

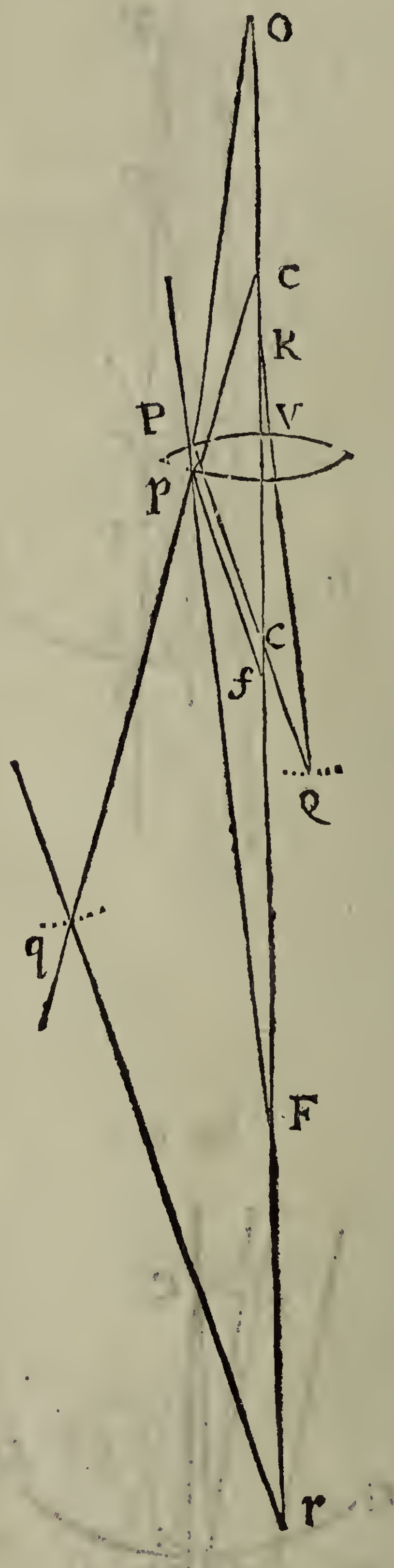
Or elſe, As *C Q*: To *O P* or *R Q*: : So *P C*: To *V F*, the focal Diſtance from the Pole of the Glaſs.

Whence follows a General Rule for the Foci of all Glaſſes, only according to *Cor.* 3. if *O V* do exceed *C R*, the Focus is on the ſame Side of the Glaſs, as the Center of the Sphere: But if *C R* be greater, then the Focus is on the oppoſite Side of the Glaſs; whence it will be determined, whether the Focus be real or imaginary.

COROLLARY VI.

What has been ſaid of one Surface of a *Lens*, is eaſily applicable to the other; taking *F*, the Focus of the firſt Surface, as an Object, and uſing it as *O* in the Figures for emerging Rays; whereby the Focus of both Surfaces will be determined, as in *Fig.* 6.

Fig. 1.



COROLLARY VII.

Hitherto we have conſidered only *Oblique Rays*, either diverging or converging: It now remains to add ſomething concerning *Rays parallel* to the Axis.

In this Caſe the Point *O* muſt be conſidered as infinitely diſtant; and conſequently *O P*, *O C*, and *C R*, are all infinite; and *O P*, *O C*, are in this Caſe to be accounted always equal, (ſince they differ but by a part of the Radius of the Sphere *G P V L*, which is no part of either of them;) wherefore the Ratio of *C R* to *O P* will be always the ſame, *viz.* as *s* to *r* for immerging Rays, and as *r* to *s* for thoſe that emerge; and by this Propoſition, *C F* is to *P F* in the ſame Ratio.

This Problem has been very fully conſidered by the celebrated Dr. *Wallis*, in his *Treatiſe of Algebra*, *Pag.* 258; but the Conſtruction thereof muſt be repeated here: See *Fig.* 1. preceding, and this following one.

Fig. 2.

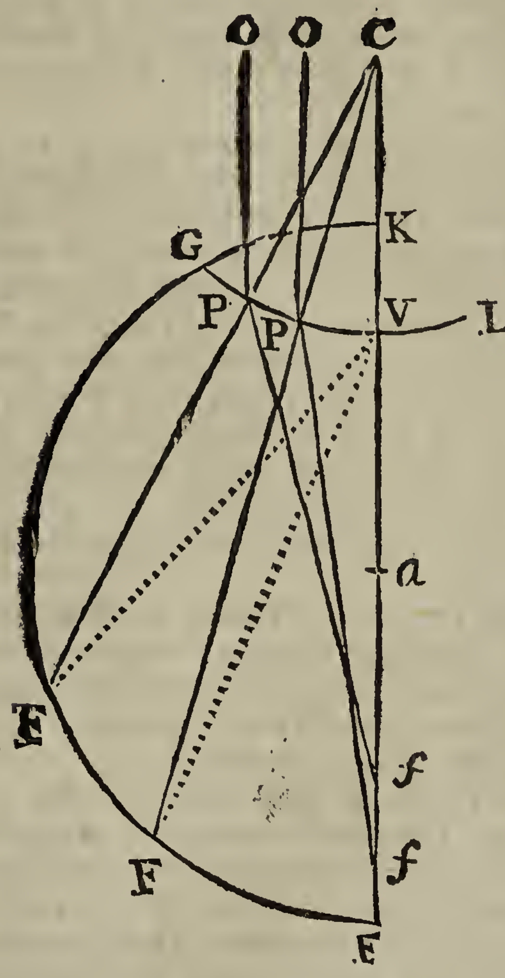
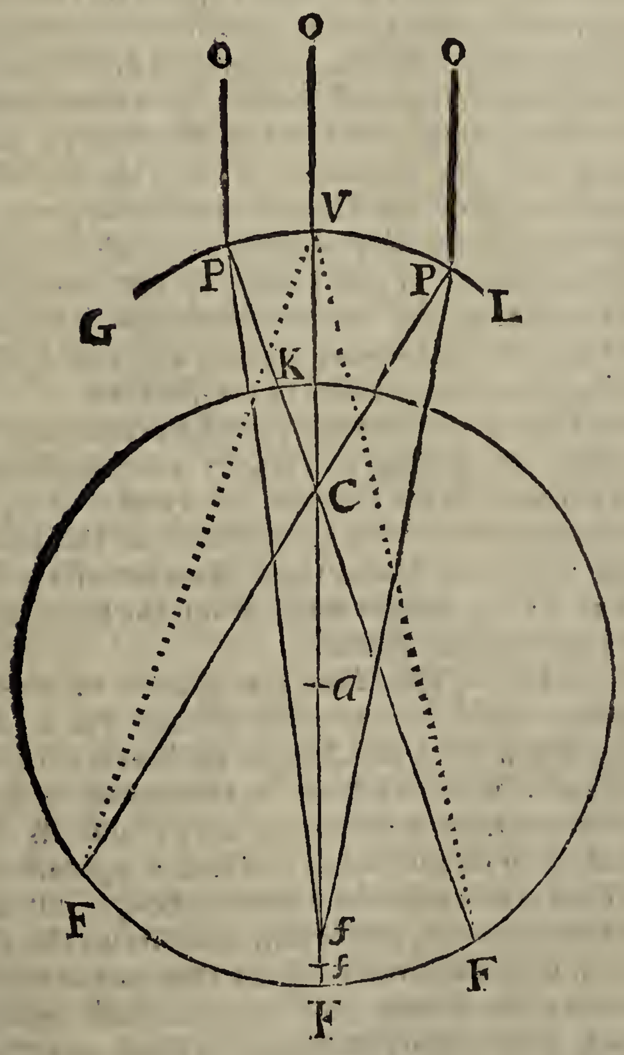


Fig. 2.



Let $G\ PVL$ be a *Lens*, VC or PC the Radius of its Sphere; and let it be required to find all the Points f, f, ſo as Cf may be to Pf, in the given Ratio, as s to r for immerging Rays, or as r to s for the emerging.

Divide CV in K, and continue CV to F, that CK may be to VK, as CF to VF, in the propoſed Ratio: Then divide KF equally in the Point a; and with that Center ſweep the Circle FKF; this Circle being drawn, gives readily all the Foci of the parallel Rays OP, OP: For having continued CP till it interſect the Circle in F, PF ſhall be always equal to Vf, the diſtance of the Focus of each reſpective Parcel of Rays OP, from the Vertex or Pole of the *Lens*.

Demonſtration.

Draw the prick'd Line VF; and by what is delivered by Dr. *Wallis* in the afore-cited Place, VF and CF will be always in the ſame propoſed Ratio.

Again, Vf being made equal to PF, CF and Cf will be likewiſe equal, as are CP and VC; and the Angles PCf, and VCF, being *ad verticem*, are alſo equal: Wherefore Pf will be equal to VF, and conſequently Cf to Pf in the ſame Ratio as CF to Vf; whence, and by what foregoes, the Points f, f, are the ſeveral reſpective Foci of the ſeveral Parcel of Rays OP, OP. Q. E. D.

That CF is to PF in the Ratio of the Refraction in the Caſe of parallel Rays, will yet be more evident, if it be conſidered, that the Angle at C is equal to the Angle of Incidence, and the Angle at P to the refracted Angle; wherefore PF the Side oppoſite to the Angle at C, is as the Sine of the Angle of Incidence; and CF oppoſite to the Angle at P, is as the Sine of the reſpective refracted Angle. Whence in all Caſes of parallel Rays, CF is to PF in the ſame conſtant Ratio of Refraction.

If it ſhall be deſired to effect in Numbers what we have here done by Lines, it will be moſt eaſy to adapt a Calculus to the foregoing Geometrical Conſtruction.

For if in the Triangle POC, there be given the Radius CP equal to Unity, CO the Diſtance of the Object from the Center of the Sphere, and the perpendicular Px, equal to the Sine of the Angle PCO, the Side $PO = QR$ will be equal to $\sqrt{\overline{CO}^2 + \overline{CP}^2 + 2\,CO}$ in $\sqrt{\overline{CP}^2 - \overline{Px}^2}$.

Then, As QR or PO: To Px:: So CR: To the Sine of the Angle CQR, and the Complement to 180 Degrees of the Sum of the Angles CPO and CQR, is the Angle CRQ equal to CFP; and as Px: To PO:: So is the Sine of the Angle CRQ: To CQ; and as CQ: To CP:: So CR: To CF; which is the Diſtance of the reſpective Focus of all the Rays PO, from the Center of the Sphere C.

But the Foci of Rays parallel to the Axis may be computed more readily, following the Footſteps of the Conſtruction; for thereby it will appear, that the Radius of the Circle KF, *viz.* aF, is equal to $\frac{rs}{rr-ss}\,CP$, and $Ca = \frac{rr}{rr-ss}\,CP$, for emerging Rays, as in *Fig.* 1. but for immerging Rays, as *Fig.* 2. Ca will be found to be $\frac{ss}{rr-ss}\,CP$: And ſuppoſing the Diſtance of the Rays from the Axis $= Px$ in the Caſe of parallel Rays emerging, the Diſtance of the Focus will be found,

$$PF = \frac{rr}{rr-ss}\sqrt{\overline{CP}^2 - \overline{Px}^2} + \sqrt{\frac{rs}{rr-ss}\,\overline{CP}^2 - \frac{rr}{rr-ss}\,\overline{Px}^2} - CP:$$

That is, r to s being as 3 to 2.

$$PF = \frac{9}{5}\sqrt{CP^2 - Px^2} + \sqrt{\frac{6}{5}CP^2 - \frac{9}{5}Px^2} - CP.$$

And for immerging Rays, the focal Diſtance is found by a like Rule:

$$PF = \frac{ss}{rr-ss}\sqrt{CP^2 - Px^2} + \sqrt{\frac{rs}{rr-ss}CP^2 - \frac{ss}{rr-ss}Px^2} + CP.$$

That is, r and s being as 3 to 2, as before.

$$PF = \frac{4}{5}\sqrt{CP^2 - Px^2} + \sqrt{\frac{6}{5}CP^2 - \frac{4}{5}Px^2} + CP.$$

Theſe Canons are ſo eaſily deduced from the Conſtructions, that there is no need to trouble the Reader with their Demonſtrations, only you have here added two Tables computed from them, with little more Work than a continual Addition; which may, by way of Example, ſerve to inſtruct and exerciſe the young Student in this Part of the Mathematicks.

Suppoſe CP, the Radius of the Sphere of Glaſs, 2 Inches, and the Ratio of Refraction as 3 to 2; at each Tenth of an Inch diſtance from the Axis the Foci are as follows.

For emerging Rays.

Px	P F
0	$\sqrt{12.9600}+\sqrt{5.7600}+2$
1	$\sqrt{12.9276}+\sqrt{5.7276}-2$
2	$\sqrt{12.8304}+\sqrt{5.6304}-2$
3	$\sqrt{12.6684}+\sqrt{5.4684}-2$
4	$\sqrt{12.4416}+\sqrt{5.2416}-2$
5	$\sqrt{12.1500}+\sqrt{4.9500}-2$
6	$\sqrt{11.7936}+\sqrt{4.5936}-2$
7	$\sqrt{11.3724}+\sqrt{4.1724}-2$
8	$\sqrt{10.8864}+\sqrt{3.6864}-2$
9	$\sqrt{10.3356}+\sqrt{3.1356}-2$
10	$\sqrt{9.7200}+\sqrt{2.5200}-2$

For immerging Rays.

Px	P F
0	$\sqrt{2.5600}+\sqrt{5.7600}+2$
1	$\sqrt{2.5536}+\sqrt{5.7536}+2$
2	$\sqrt{2.5344}+\sqrt{5.7344}+2$
3	$\sqrt{2.5024}+\sqrt{5.7024}+2$
4	$\sqrt{2.4576}+\sqrt{5.6576}+2$
5	$\sqrt{2.4000}+\sqrt{5.6000}+2$
6	$\sqrt{2.3296}+\sqrt{5.5296}+2$
7	$\sqrt{2.2464}+\sqrt{5.4464}+2$
8	$\sqrt{2.1504}+\sqrt{5.3504}+2$
9	$\sqrt{2.0416}+\sqrt{5.2416}+2$
10	$\sqrt{1.9200}+\sqrt{5.1100}+2$

But it is to be noted, That theſe Foci for immerging Rays muſt not be taken for the Foci of a Plano-Convex, when the Convex-ſide is towards the Object; for the Plane-ſide, by its Refraction, does contract the focal Length by about a Semidiameter of the Sphere; theſe ſuppoſe the Body of Glaſs continued.

The ſame ingenious Author, as an Inſtance of the Excellence of the *Modern Algebra*, gives alſo in *Philoſ. Tranſ. N.* 205. a Way to find the Foci of all Optick Glaſſes univerſally; and ſhews of what great Uſe his and ſuch Theorems are.

FODDER, or *Fother* of Lead, is a Weight containing eight Pigs; every Pig three Stone and an half. In the Book of Rates, a Fodder of Lead is ſaid to be 2000 *lb.* Weight; at the Mines, it is $22\frac{1}{2}$ Hundred; and among the Plumbers, at *London*, it is but $19\frac{1}{2}$ Hundred.

FODINA, is the Labyrinth in the Bone of the Ears. *L.*

FOETUS, is the Young of all kind of Creatures, more eſpecially Human; immediately after the Conception it is called an *Embryo*, but when its Formation in the Womb is perfectly finiſhed, it is properly termed the *Fœtus.* L.

Dr. *Drake*, in *Phil. Tranſ. N.* 281. ingeniouſly tells us, That the Nouriſhment of the *Fœtus* in the Womb, (which he makes to have a little more than Vegetative Life, and to be a Graft, as it were, upon the Stock of the Mother) is by Transfuſion of the Blood from the Hyſterick Arteries, immediately to the Umbilical Vein, together with ſuch Nutritious Juices and Aerial Particles as the Blood is ſuppoſed to carry along with it: By which Means ſo much of the Impulſe of the Mother's Blood is preſerved, as is ſufficient to maintain that languid Circulation which the Fœtus enjoys; for the Blood being driven through the *Arteries* of the *Uterus* into the Umbilical Vein, is conveyed directly to the *Sinus* of the *Porta*, and thence, by a ſhort and direct Paſſage, thro' the *Cava* to the Heart; where paſſing thro' the *Foramen Ovale* to the *Left Ventricle*, and thro' the *Canalis Arterioſus* from the *Right* and *Pulmonary Artery*, it is all delivered, without coming at the Lungs, to the *Aorta*; and from thence again, by the Umbilical Arteries to the Veins of the *Uterus*, making a ſort of *Epicycle* to the main Circulation in the Mother.

And this is confirmed by the Experiments of the accurate Mr. *Cowper*, who, by pouring *Mercury* into a Branch of the *Uterine Artery* of a Cow, that went into one of the *Cotyledones* of the *Uterus*, filled with that Metal thoſe Branches of the Umbilical Veins, which went from the *Cotyledon* to the Navel of the *Fœtus*.

FOETUS. The *Fœtus* is almoſt of an Oval Figure, whilſt it lies in the Womb: For its Head hangs down with its Chin on its Breaſt; its Back is round; with its Arms it embraceth its Knees, which are drawn up to its Belly; and its Heels are cloſe to its Buttocks; its Head is upwards, and its Face is towards the Mother's Belly. But about the ninth Month, in the Humane Fœtus, the Head, which was ſpecifically lighter than any other Part, becomes ſpecifically heavier; its Bulk bearing a much ſmaller Proportion to its Subſtance than it did before; and conſequently it muſt now tumble and ſink down in that Liquor in which it ſwam, as it were, before: So its Head falls down, its Feet gets up, and its Face turns towards the Mother's Back. But becauſe 'tis then in an irkſom, tho' proper, Poſture for its Exit, the Motion it makes for Relief gives frequent and great Pains to the Mother; which cauſe a Contraction of the Womb, for the Expulſion of the *Fœtus*. When it happens to preſent it ſelf in any other Poſture, it ſhould be carefully put back again; and, if poſſible, turn'd the right Way by the Midwife: But if that can't be done, it ſhould be drawn out by the Feet.

FOG, a Meteor conſiſting of groſs Vapours, which float near the Surface of the Earth. If the Vapours which are rais'd plentifully from the Earth and Waters, either by the ſolar or ſubterraneous Heat, do at their firſt entrance into the Atmoſphere meet with Cold enough to condenſe them to a conſiderable Degree, their ſpecifick Gravity is by that Means increas'd; and ſo they will be ſtopp'd from aſcending, and return back either in form of *Dew*, or drizzling Rain; or remain ſuſpended ſome time in the form of a *Fog*.

We many times obſerve in a hot Day, when there is no Wind ſtirring, ſuch a Company of Vapours riſe out of moiſt Ground, as make thick Fogs, which are ſometimes higher and ſometimes lower, as the multitude and motion of the Vapours happens to be. They are to be ſeen on the high Grounds as well as the low; but more eſpecially about marſhy Places. They are eaſily diſſipated by the Wind, and particularly by a drying Wind. The Sun hath the ſame Effect upon them; and we commonly ſee, when there are thick Fogs about Sun-riſing, that they diſappear a little while after it is up.

It is plain that *Fogs* conſiſt of watry Particles rarified, becauſe they mightily bedew every thing that lies open to them. Theſe Particles being ſtrongly mov'd, muſt needs fly up aloft in the Air; but if their Motion be ſomething faint, they play about the Surface of the Earth. For this is agreeable to the Laws of Motion, that ſuch Things as are about the Globe of the Earth, the more they are moved, the more they recede from the Centre of the Earth.

Again, thoſe Fogs riſe out of all Places mountainous or champaign, and continue till they are diſpell'd by Wind or Heat; but their Continuance is longeſt in the loweſt Grounds, becauſe thoſe Places are fulleſt of Moiſture, and are not ſo much expos'd to the Winds. But when the Wind riſes upon them, wherever they be, they are diſſipated and driven about, till we ſee no more of them. So in like manner the Heat of the Sun, putting them into a briſker Motion, either diſſipates them by Rarefaction, or raiſes them higher, and forms them into Clouds. For *Fogs* are only low *Clouds*, or *Clouds* in the loweſt Region of the Air; and *Clouds* are no other than *Fogs* raiſed on high.

Sometimes the *Fogs* ſtink, not becauſe they come from ſtinking Water; but becauſe the Vapours are mixt with ſulphureous Exhalations, which ſmell ſo. Theſe Exhalations perhaps would fly up directly to the Clouds, if there were no *Fogs* to hold them, and ſo would not affect our Smell; but after they are entangled and blended with the Fog, they laſt as long as that does.

Objects view'd thro' Fogs, appear larger and more remote than thro' the common Air.

FOGAGE, [in the Foreſt *Law*,] is rank Graſs not eaten in the Summer.

FOLIA [with *Botaniſts*,] is us'd for the Leaves of Plants and Flowers both; but more particularly for thoſe of the Plants; but the Leaves of Flowers are more properly call'd *Petala*. L.

FOLIACEUM *Expanſum*, [in *Anatomy*,] is that Extremity of the fallopian Tube, which is next to the Ovary, and is expanded like the Mouth of a Trumpet, and invironed with a ſort of Fringe.

FOLIAGE, the branched Work in Tapeſtry or Painting; alſo a kind of Ornament uſed in Cornices, Frizes, Capitals of Pillars, and other Members of Architecture; ſome of which repreſent the Leaves of the Herb *Brank-Urſine* or *Bear's Foot*; and others thoſe of divers ſorts of Trees, as the *Oak*, *Laurel*, *Olive*, *Vine*, &c.

FOLIATE; to *foliate* Looking-Glaſſes, is to ſpread a Compoſition of ſomething which will firmly adhere to the Back of the Glaſs, and there reflect the Image. This is called the *Foile*, and is uſually made with Quickſilver mix'd with ſome other Ingredients.

FOLIATE. In *Phil. Tranſ.* Nº 245. there is a Way, communicated by Sir *Rob. Southwell*, of foliating the Globe Looking-glaſſes. The Mixture is of Quickſilver and Marchaſite of Silver, of each 3 Ounces; Tin and Lead, of each half an Ounce; Theſe two firſt thrown on the Marchaſite, and laſt of all the Quickſilver. Stir them well together over the Fire, but they muſt be taken off it, and be towards cooling, before the Quickſilver is put to them. When you uſe it, the Glaſs ſhould be well heated, and very dry: But it will do alſo when 'tis cold, but beſt when the Glaſs is heated.

This is a little odly expreſs'd: But I ſuppoſe 'tis meant, that the Marchaſite ſhould be powder'd, the Lead and Tin melted and poured upon it, and then all well ſtirred and mixed together while in Fuſion; and afterwards, when 'tis almoſt cold, the 3 Ounces of Mercury put to it to make the Amalgama.

FOLIATION, according to Dr. *Grew*, is one of the Parts of a Flower of a Plant, being the Collection of thoſe fugacious coloured Leaves (in *Latin Petala*) which conſtitute the compaſs of the Flower; and alſo, ſometimes to ſecure and guard the Fruit which ſucceeds the *Foliation*, as in Apples, Pears, &c. and ſometimes ſtands within it, as in Cherries, Abricots, &c. for theſe being of a very tender and pulpous Body, and coming forth in the colder Part of the Spring, would be often injured by the Extremities of Weather, if they were not thus protected and lodged up within their Flowers. *L.*

The *Foliation* alſo is ſerviceable to the Growth of the Fruit in its Infancy or Embryo-State, being always proportionable to the Nature of the Fruit, and to the Plenty of the Sap by which the Fruit is fed or ſupplied. *Anat. of Plants*, P. 37.

The Doctor obſerves, That the Flowers of all Plants are perfectly formed or finiſhed in all their Parts long before they appear in Sight, uſually two or three Months, and ſometimes Half a Year or more: And though uſually the Flower appear before the Seed, yet is the Seed firſt formed, and then the Flower.

FOLK-*Land*, was the *Terra vulgi*; the Land of the Common People who had no Eſtate therein; but held the ſame under ſuch Rents and Services as were accuſtomed or agreed, at the Will only of their Lord the *Thane*; and therefore their *Bargain was not put in Writing*, as that about the *Boc-Land* was, but was accounted *Prædium Ruſticum & Ignobile*.

FOLKMOTE, was the general Word for a popular Convention of all the Inhabitants of any Place; which if it were of thoſe of a City or

Town, it was called a *Burgh-mote* ; but if of all the Free Tenants of a County, 'twas called a *Schire-mote*. In Towns and Burghs, this ſolemn Aſſembly was made by the Sound of a Bell call'd the *Mothell*. In the County *Folk-mote*, all Knights and Free Tenants did their Fealty to the King, and elected their annual Sheriff formerly, (on the 1ſt of *October)* before the King nominated. But after that, (about the Time of *Edward* II.) the City *Folk-mote* was changed into the Common Council, and the County *Folk-mote* into the *Sheriffs Turn* and *Aſſizes*. The Word *Folk-mote* had alſo ſometimes a leſs Extent, ſignifying only the Aſſembly of the Tenants to a *Court Leet* or *Baron* of their Lord.

FOLLICULUS, a Term in Botany, ſignifying the Seed-Veſſel, *Capſula Seminalis*, the Caſe, Huſk, Coat, or Cover, which ſome Fruits and Seeds have over them ; as that of the *Alkekengi*, the *Pedicularis*, &c. L.

FOLLICULUS *Fellis*, or *Veſica Bilaria*, is a little Bladder faſtned to the Concave Part of the Liver, and receives the Bile, which in Proceſs of Time empties it ſelf into the Gut *Duodenum*, by a *Ductus* or Paſſage called *Choledockus Ductus*. L.

FOMAHANT, a Star of the firſt Magnitude in *Aquarius*, whoſe Longitude is 329 Degrees 17 Minutes, Latitude 21 Degrees 3 Minutes.

FOMENTATION, is the bathing of any Part of the Body with a convenient Liquor ; which is uſually a Decoction of Herbs in Water, Wine, or Milk: Alſo applying of Bags ſtuff'd with Herbs and other Ingredients ; which is commonly called a *Dry Fomentation*. L.

FONTANELLÆ, or *Iſſues*, are little Ulcers which Surgeons make in ſound Parts of the Body, to evacuate Humours, cure Diſeaſes, or prevent them. *Iſſues* are made either with an actual or a potential Searing-Iron, with a Lancet, and a Pair of Sciſſers, &c. You muſt always obſerve to make *Iſſues* betwixt two Muſcles. *Blanchard*. L.

FOOL. Dr. *Willis*, in his Treatiſe *Nervorum Deſcript.* &c. relates, that in diſſecting the Body of a *Fool*, the principal Differences that appear'd between him and a Man of Senſe, were, that the Brain was ſmaller, and that the cervical *Plexus*, form'd of the intercoſtal Nerve, whereby the Correſpondence between the Brain and Heart is affected, was leſs, and ſent forth fewer Branches to the Heart.

FOOT, [in *Anatomy*,] or the Great Foot, call'd *Magnus Pes*, is the whole Extent from the Jointure of the Hip, to the tip of the Toes, divided into the Thigh, the Leg, and the Foot; after the ſame manner, the whole Hand is reckoned from the Shoulder to the Fingers ends.

The leſſer FOOT, is that which is properly call'd the Foot, and conſiſts of three Parts, *viz.* the *Tarſus*, the Space from the Ancle to the Body of the *Foot* ; the *Metatarſus*, from the Body of the *Foot* to the Toes ; and the *Digiti*, or Toes.

FOOT, [in *Poetry*,] is the Metre or Meaſure of the Verſe ; which Feet are compoſ'd of long and ſhort Syllables, as *Spondee*, *Dactyl*, *Trochee*, &c.

Engliſh FOOT, [in *Meaſure*,] conſiſts of 12 Inches, and the Inch of 3 Barley-Corns.

Geometrical Foot is divided into 10 Digits, the Digit into 10 Lines, &c.

French Foot is divided like the *Engliſh* into 12 Inches, and the Inches into 12 Lines.

A Foot ſquare, is the ſame in Breadth that it is in Length, and contains 144 ſquare or ſuperficial Inches.

A Cubick Foot, } *A Solid Foot*, } is the ſame Meaſure in all three Dimenſions, in Length, Breadth, and Depth or Thickneſs, containing 1728 Cubick Inches.

The Foot is of different Lengths in different Countries. The *Paris Royal* Foot exceeds the *Engliſh* by ſeven Lines and a half; the *Leyden* or *Rhineland* Foot, by which all the Nations go, is to the *Roman* Foot as 950 to 1000 ; and the Antient *Roman* Foot of the Capital, conſiſted of four Palms, which are equal to 11 Inches $\frac{4}{10}$ *Engliſh*.

The Proportion of the principal Feet of ſeveral Nations compared with the *Engliſh* and *French*, are as follows.

The *Engliſh* Foot being divided into a 1000 Parts, or 12 Inches, the other Feet will be as follows.

	Parts	F.	Inch.	L.
London Foot	1000	0	12	0
Amſterdam Foot	943	0	11	3
Antwerp Foot	946	0	11	2
Bononia Foot	1204	1	2	4
Bremen Foot	964	0	11	6
Cologn Foot	954	0	11	4
Copenhagen Foot	965	0	11	6
Dantzick Foot	944	0	11	3
Dort Foot	1180	1	2	2
Frankfort on the *Mayn* Foot	984	0	11	4
The *Greek* Foot	1007	1	00	1
Lorrain Foot	958	0	11	4
Mantua Foot	1569	1	6	8
Mechlen Foot	919	0	11	0
Middleburgh Foot	991	0	11	9
Paris Royal Foot	1068	1	00	8
Paris Foot by Dr. *Bernard*	1066	1	00	1
Prague Foot	1026	1	00	3
Rhinland or *Leyden* Foot	1033	1	00	4
Riga Foot	1831	1	9	9
Roman Foot	967	0	11	6
Old *Roman* Foot	970	0	11	6
Strasburg Foot	920	0	11	0
Toledo Foot	899	0	10	7
Turin Foot	1062	1	00	7
Venice Foot	1162	1	1	9

The *Paris* Foot being ſuppos'd to contain 1440 Parts, the reſt will be as follows.

	Parts
Paris Foot	1440
Bononian Foot	$1682\frac{2}{3}$
Conſtantinopolitan Foot	3120
Daniſh Foot	1403
Dantzick Foot	$1721\frac{1}{2}$
Hall Foot	1320
London Foot	1350
Noremburg Foot	$1346\frac{1}{4}$
Strasburg Foot	$1382\frac{3}{4}$
Rhinland Foot	$1391\frac{3}{10}$
Roman Foot	1320

FOOT *Level*, [with *Artificers*,] an Inſtrument that ſerves to do the Office of a foot Rule, a Level and a Square.

FOOT *of the Foreſt*, [in our *Antient Cuſtoms*,] contained a Foot and half of the common Foot, or 18 Inches.

FOOT *Husks*, [in *Botany*,] ſhort Husks or Heads out of which Flowers grow.

FOOT-*Bank*, or a *Banquette*, [in *Fortification*,] is a ſmall Step of Earth on which the Soldiers ſtand to fire over the Parapet.

FOOT-*Gelde*, was an antient Amerciament for not cutting out the Balls of the Feet of great Dogs in the Foreſt; which was done for preventing their running after the King's Deer; and was called *Expeditation*.

FORAMEN *Arteriæ Duræ Matris*, is a Hole in the *Cranium*, which allows a Paſſage for the Artery belonging to the *Dura Mater*. L.

FORAMEN *Lacerum*, is the third Hole in the *Os Phœrcides*, by which the third Pair of Nerves paſs out of the *Cranium*.

FORAMEN *Lachrymale*: See *Lachrymale Punctum*.

FORAMEN *Membranæ Tympani*, [in *Anatomy*,] is a Perforation in the Membrane of the *Tympanum* or Drum of the Ear, which admits of the Paſſage of Wind, Smoke, &c. from the *Meatus a palato* to the Drum. This Paſſage is very ſmall, running obliquely from the *Tympanum* thro' the upper Part of its Membrane, near the Proceſs of the *Meatus*. L.

FORAMEN *Ovale*, [in *Anatomy*,] an Oval Aperture or Paſſage through the Heart of a *Fœtus*, which cloſes up after the Birth. It ariſes above the coronal Vein, near the right Auricle, and paſſes directly into the left Auricle of the Heart, ſerving for the Circulation of the Blood in the *Fœtus*, till ſuch time as the Infant breathes, and the Lungs are open. It is generally allow'd to be one of the temporary Parts of the *Fœtus*, wherein it differs from an Adult.

But Dr. *Conner* ſays, that he hath found it but half clos'd in a Girl of four or five Years of Age; and that in another, there was room left to thruſt in a Tent. And Mr. *Cowper* ſays, he has found the *Foramen Ovale* open in Adults. And the *Paris* Anatomiſts ſay, that the *Foramen Ovale* is always open in a Sea-Calf, by which means it is enabled to ſtay ſo long under Water.

But Mr. *Cheſelden* oppoſes theſe Authorities, and maintains, that the *Foramen Ovale* is neither open in any adult Land Animals, nor in amphibious Creatures; and that tho' he had no diſtruſt of the frequent Account in Authors of the *Foramen Ovale* being open, when he firſt apply'd himſelf to Diſſection; yet he afterwards found that he miſtook the *Oſtium* of the coronary Veins for the *Foramen*; and ſuppoſes that other Authors have done ſo too, who affirm it is always open in amphibious Animals; for that he could never find it open in any of them, tho' he had made a diligent Inquiry. And he is of Opinion, that that is not ſufficient to enable thoſe Creatures to live under Water, as the *Fœtus* doth *in Utero*, unleſs the *Ductus arterioſus* were open alſo.

FORCE, [in *Common Law*,] ſignifies an Offence, by which Violence is uſed to Perſons or Things; and is either *Simple* or *Compound*.

Simple Force, is that which is ſo committed, that it hath no other Crime adjoined to it: As if one by *force* do enter into another Man's Poſſeſſion without doing any other unlawful Act.

Mixt or *Compound Force*, is that Violence which is committed with ſuch a Fact, as of it ſelf only is Criminal; as if any by *force* enter into another Man's Poſſeſſion, and do kill a Man, or raviſh a Woman there, &c.

Force is alſo divided into true *Force*, and *Force* after a ſort, with ſeveral other Branches; as *forcible* Entries, *forcible* Detaining, unlawful Aſſembly, Routs, Riots, Rebellions, &c.

FORCEPS, is an Inſtrument wherewith dead and corrupt Parts (alſo things beſides or againſt Nature) are ſeized, cut off, or pulled out; they are of ſeveral Shapes, as long, crooked with Teeth, with Beaks, in faſhion of an Half Moon, ſuch as will open the Mouth of the Womb, and by which you may ſee into either of them; which, according to the Difference of their Shape, are of different Uſe. *Blanchard*. L.

FORCIBLE *detaining or holding of Poſſeſſion*, is a violent Act of Reſiſtance by ſtrong Hand of Men weapon'd with Harneſs, or other Action of Fear in the ſame Place, or elſewhere, whereby the lawful Entry of Juſtices or others is barr'd or hinder'd.

FORCIBLE *Entry*, is a violent actual Entry into a Houſe or Land, &c. or taking a Diſtreſs of any Perſon weapon'd, whether he offer Violence, or Hurt to any there, or furiouſly drive any out of the Poſſeſſion thereof.

FORE-CASTLE *of a Ship*, is that Part where the Fore-Maſt ſtands, and 'tis divided from the reſt of the Floor by a Bulk Head; that Part of the *Fore-Caſtle* which is aloft, and not in the Hold, is called the *Prow*.

FORE-FOOT, a Sea Term for one Ship's lying or ſailing croſs another's way; as if two Ships being under Sail, and in ken of one another, one of them lies in a Courſe, with her Stem ſo much a Weather the other, that if they both hold on their Courſe, the Windward Ship will run or go out a-head of the other; and then they ſay ſuch a Ship lies with the others *Fore-foot*; tho' as ſoon as ſhe has paſſed her, or gone out before her a-head, they do not ſay, ſhe paſſed by her *Fore-foot*, but that ſhe is *gone out a-head*.

FORE-JUDGED *the Court*, is when an Officer of any Court is expelled the ſame for ſome Offence, or for not appearing to an Action by Bill filed againſt him; and in the latter he is not to be re-admitted till he ſhall appear, but ſhall loſe his Office, and be *fore-judged the Court*.

FORE-JUDGER, [in *Law*,] ſignifies a Judgment, whereby a Man is deprived, or put by the Thing in Queſtion.

FORE-LAND, a Term in *Fortification*, the ſame with *Berme*.

FORE-KNIGHT, [in a *Ship*,] a Piece of Timber carv'd in the form of a Man's Head, and faſt bolted to the beams upon the ſecond Deck.

FORESTAL, is to be quit of Amerciaments and Cattle arreſted within your Land, and the Amerciaments thereof coming.

FORESTALLING, ſignifies the Buying or Bargaining for any Victuals or Wares coming to be ſold towards any Fair or Market, or from beyond the Seas towards any City, Port, Haven, Creek, or Road of this Realm, and before the ſame be there, to the intent to ſell the ſame again at a higher and dearer Price.

FORLINS, [in *Fortification*,] are Field Forts, Sconces or Fortreſſes; the flanked Angles of which, are generally diſtant 120 Fathom the one from the other; but they differ in extent and figure, according to the Situation and Nature of the Ground, having ſome of them whole Baſtions, and others only Demi-Baſtions.

They are us'd only for a Time; either to defend the Lines of Circumvallation or to guard ſome Paſſage or dangerous Poſt.

FORE-LOCKS, in a Ship, are little flat Wedges like Pieces of Iron, uſed at the Ends of Bolts, to keep the Bolts from flying out of the Holes: They are uſed alſo to keep faſt down the Cap-ſquares of the Carriages for the Guns; theſe are alſo called *Forelock Keys.*

FORE-MAST of a Ship, is a round large piece of Timber, ſeated in her fore-part or fore-Caſtle, on which is born the fore-Sail and foretop-ſail-Yards. Its Length is uſually $\frac{8}{9}$ of the Main-maſt; the foretop-Maſt is half the Length of the fore-Maſt, and the foretop-gallant-Maſt is half the Length of the foretop-Maſt.

FORE-REACH: The Seamen ſay one Ship *fore-reaches* upon another, when both ſailing together, ſhe ſails better or out-goeth the other.

FORE-STAFF: See *Croſs-ſtaff*; being an Inſtrument uſed at Sea, for taking the Altitude of the Sun, Moon, or Stars, with ones Face towards the Object.

Fore-Staff, is an Inſtrument uſed at Sea to take the Sun's Altitude, or the Height of the Moon, or any Star in the Night; and 'tis ſo call'd, becauſe when 'tis uſed, your Face is to the Object: Whereas in the Uſe of the *Back-Staff*, or *Davis's Quadrant*, the Back of the Obſerver is towards the Sun. The *Fore-ſtaff* is the ſame with the *Croſs-ſtaff:* Which you will find fully deſcribed under that Word.

FOREIGN, is in Law uſed adjectively, being joined with divers Subſtantives in ſeveral Senſes: As,

FOREIGN *Anſwer*, is ſuch an Anſwer as is not triable in the County where it is made.

FOREIGN *Attachment*, is an Attachment of Foreigners Goods found within a Liberty or City, in the Hands of a third Perſon, for the Satisfaction of ſome Citizen, to whom the ſaid Foreigner oweth Money.

FOREIGN *Matter*; that is, Matter triable in another County.

FOREIGN *Oppoſer*, or *Appoſer*, is an Officer in the Exchequer, to whom all Sheriffs and Bayliffs repair to be appoſed by him of their Green Wax, after they are appoſed of their Sums out of the Pipe-Office; and from thence draws down a Charge upon one of them to the Clerk of the Pipe: His Buſineſs is to examine the Sheriffs Eſtreats with the Record, and to ask the Sheriff, what he ſays to every particular Sum therein.

FOREIGN *Plea*, is a Refuſal of the Judge as Incompetent, becauſe the Matter in Hand was not within his Precinct.

FOREIGN *Service*, is ſuch Service, whereby a mean Lord holdeth over of another, without the Compaſs of his own Fee; or elſe that which a Tenant performeth either to his own Lord, or to the Lord Paramount of his own Fee.

FOREST, is a large Wood privileged to hold the King's Game of all kind.

The Properties of a Foreſt are theſe;

Firſt, A Foreſt, as it is truly and ſtrictly taken, cannot be in the Hands of any but the King, for none hath Power to grant a Commiſſion to be a Juſtice in *Eyre*, or the *Foreſt*, but the King.

The ſecond Property conſiſts in the Courts, as the *Juſtice-Seat* every three Years, the *Swain-Mote* thrice every Year, and the *Attachment* once every forty Days.

The third Property, are the Officers belonging to it, for the Preſervation of the Vert and Veniſon; as the Juſtices of the Foreſt, the Warden or Keeper, Verderers, Foreſters, Agiſtors, Regarders, Bayliffs, Beadles, and ſuch like.

FORESTER, is a Sworn Officer of the Foreſt, appointed by the King's Letters-Patent to walk the Foreſt both early and late, watching both the Vert and Veniſon, attaching and preſenting all Treſpaſſes againſt them within his own Bailiwick or Walk: And tho' theſe Letters-Patents be ordinarily granted but *quam diu ſe bene geſſerint*, yet ſome have it to them and their Heirs, and thereby are called *Foreſters in Fee.*

FORFEITURE, in our Language, ſignifies rather the Effect of tranſgreſſing a Penal Law, than the Tranſgreſſion it ſelf; as *Forfeiture of Eſcheats.*

FORFEITURE *of Marriage*, is a Writ lying againſt him, who holding by Knights Service, and being under Age, and Unmarried, refuſes her whom the Lord offers him with his Diſparagement, and marrieth another.

FORFEX, is an Inſtrument to pull out Teeth with. *L.*

FORGERY: See the next following, *viz.*

FORGER *of falſe Deeds*, in Law, ſignifies either him that fraudulently maketh and publiſheth *falſe Writings*, to the Prejudice of any Man's Right; or elſe the Writ that lieth againſt him that committeth this Offence, which by ſome is called *The Writ of Deceit.*

FORLORN-*Hope*, or the *Enfans Perdue* in an Army.

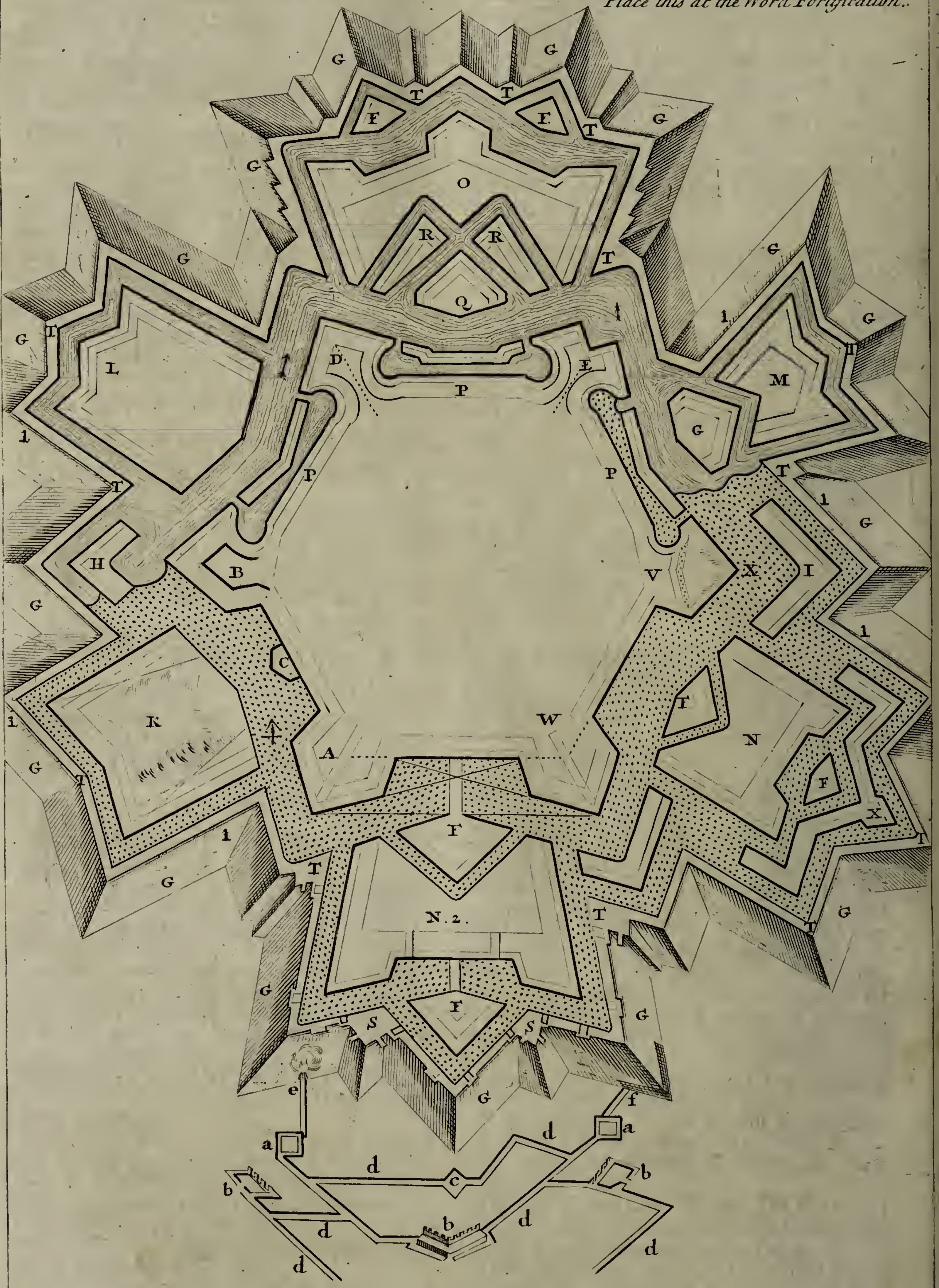
FORM of any natural Body, is the eſſential, ſpecifical, or diſtinguiſhing Modification of the Matter of which it is compoſed, ſo as thereby to give it ſuch a peculiar manner of Exiſtence: And this is an Aggregate or Convention of as many particular Qualities, as ſerve to denominate the Body of ſuch a Nature, and to give it ſuch a Name; and which diſtinguiſhes it from other Bodies. Thus the Qualities of greateſt ſpecifick Gravity, Fixity in the Fire, Ductility under the Hammer, Paucity, and yet Largeneſs of Pores, Diſſolubility in *Aqua regia* and not in *Aqua fortis*, and Yellowneſs of Colour, make up the *form* of that Metal which we call Gold. So that 'tis not any kind of ſubſtantial Soul or Subſtance diſtinct from Matter, but only ſuch a proper and agreeable Convention of Accidents, as by common Conſent are reputed ſufficient to make a Portion of univerſal Matter, belong to this or that determinate Genus or Species of natural Bodies. But yet ſome are of Opinion, That the Human Soul may properly enough be called, a *Subſtantial Form.*

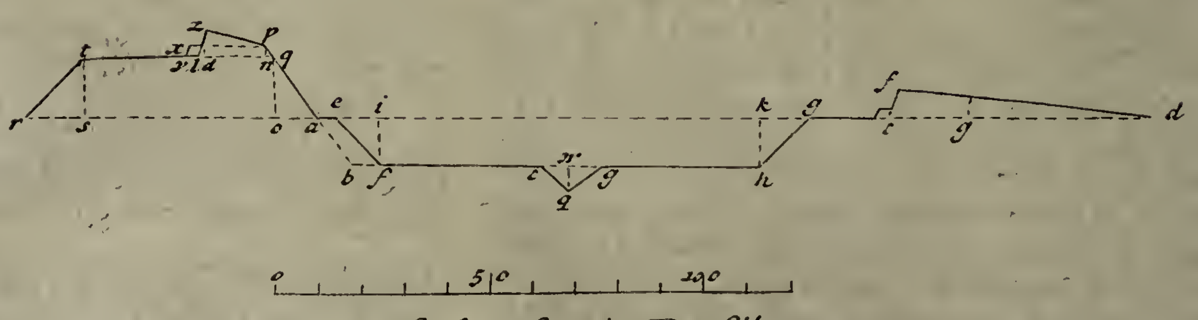
FORMATRIX, FORMATRICE. The antient Philoſophers admitted a *Virtus*, or *Facultas formatrix*, whereby all Bodies had their Forms given them.

FORMEE, as a Croſs *Formee*, [in *Heraldry*,] is a Croſs narrow in the Centre, and broad at the Extremes, moſt commonly call'd *Patee.*

FORMED *Stones*, are with the Writers of Natural Hiſtory, ſuch Bodies as being either pure Stone, Flint, or Sparr, are found in the Earth ſo formed, as that they bear a near Reſemblance to the external figure and ſhape of Muſcles, Cockles, Perewinkles, and other Shells. There hath been a great Diſpute amongſt the Naturaliſts, how thoſe Bodies came thus formed, and a great many have been very fond of (what appears to me as a very abſurd Opinion) *viz.* That theſe are only a *Luſus Naturæ*, only the Sports and Diverſions of Nature, to make her ſelf merry in the dark Regions of the Earth. But Dr. *Woodward*, in his Natural Hi-

Place this at the Word Fortification.





Scale of Feet for the Profile

ſtory of the Earth, advances a very fair Solution of this Difficulty, and proves, that theſe formed Stones, by the Diſſolution of the Earth at the Deluge, were then made, by being caſt into the Cavities of thoſe Shells which they repreſent, the Shells ſerving as Moulds to give them their proper form.

FORMEDON, is a Writ that lies for him that hath Right to any Lands or Tenements, by Vertue of an Entail: It lieth in three ſorts;

1. *Formedon in the Deſcender*, which lieth for the Recovery of Lands, &c. given to one and the Heirs of his Body, or to a Man and his Wife, and the Heirs of their Bodies, or to a Man and his Wife being Couſin to the Donor in *frank-Marriage*, and afterwards alienated by the Donee; for after his Deceaſe, his Heirs ſhall have this Writ againſt the Tenant or Alliance.

2. *Formedon in the Reverter*, lieth for the Donor or his Heirs, where Land entail'd to certain and their Iſſue, with condition for want of ſuch Iſſue, to revert to the Donor and his Heirs, againſt him to whom the Donee alienateth, after the Iſſue extinct to which it was entail'd.

3. *Formedon in the Remainder*, lieth where a Man giveth Lands in Tail, the Remainder to another in Tail; and afterwards the former Tenant in Tail dieth without Iſſue of his Body, and a Stranger abateth, then he in the Remainder ſhall have this Writ.

FORMEE, the Term ſometimes uſed for the *Croſs Patee* in Heraldry: See *Patee*.

FORMELLA, was a Weight of Lead which in 51 *H.* 3. *A. D.* 1267. is ſaid to contain ſix *Petræ*, except 2 *lb.* Each *Petra* contain'd 12 *lb.* and each Pound contained the Weight of 25 Shillings.

FORMER, is the Name of a piece of Wood turn'd round and fitted to the Bore of a piece of Ordnance, on which are founded the Cartridges which hold the due Charge of Powder for the Gun.

FORMULÆ, is the Word uſed for the Phyſicians Preſcriptions. *Blanchard*. L.

FORNICATION, is ſometimes uſed in Architecture, to ſignify Arching or Vaulting.

FORNIX, is the Callous Subſtance of the Brain, ſo called, becauſe it ſeems to ſuſtain the Cavities of the Ventricles, and the Bulk of the impending Brain, like an Arch or Vault. *L.*

FOREPRISE, [in *Law*,] an Exception or Reſervation.

FORT, is a Caſtle, or a Place of ſmall Extent, fortified either by Art or Nature.

FORT-ROYAL, is that which hath 26 Fathoms for the Line of Defence.

FORT-STAR, is a Redoubt, conſtituted by Reentring and Salient Angles, which commonly have from 5 to 8 Points: See more under the Word *Sconces*.

FORTIFICATION, or *Military Architecture*, is an Art ſhewing how to fortify a Place with *Ramparts*, *Parapets*, *Moats*, and other *Bulwarks*, to the end, that a ſmall number of Men within may be able to defend themſelves for a conſiderable time againſt the Aſſaults of a numerous Army without; ſo that the Enemy in attacking them muſt of neceſſity ſuffer great Loſs.

Fortification is either *Regular* or *Irregular*, and with reſpect to Time, may be diſtinguiſh'd into *Durable* and *Temporary*.

Regular Fortification, is that which is built on a *Regular Polygon*, the Sides and Angles whereof are all equal; being commonly about a Muſket-ſhot one from another.

Irregular Fortification, is that where the Sides and Angles are not at all uniform, equi-diſtant, or equal one to another.

Durable Fortification, is that which is raiſed to continue a long while.

Temporary Fortification, is that which is erected upon an emergent occaſion for a little time; ſuch are all ſorts of Works caſt up for the ſeizing or maintaining of a Poſt or Paſſage, as alſo *Circumvallations*, *Contravallations*, *Redoubts*, *Trenches*, *Batteries*, &c.

The principal Maxims of Fortification *are theſe*:

1. Every Place within the *Fortification* ought to be flank'd; that is, ſeen ſidewiſe, or defenſible from the other Parts, ſo that there may be no Place in which an Enemy can lodge himſelf undiſcovered by thoſe that are within, and that both from the front, the ſides, even from behind, if poſſible.

2. The Fortreſs ought to command all Places round about; and therefore all the Out-works muſt be lower than the Body of the Place.

3. The Works that are moſt remote from the Centre of the Place, ought always to be open to thoſe that are more near.

4. The *Angle Flanquant*, or the Point of the *Baſtion*, ought to be at leaſt of 70 Degrees, or as ſome ſay (Mr. *Vauban*) not more than 100, or leſs than 60.

5. The *Angle of the Courtine* ought never to be leſs than 90, or greater than 100 Degrees, becauſe if it be larger, 'tis too much ſubject to the View of the Enemy.

6. The greater the *Flank* and *Demigorge* is in Proportion to other Things, the better; becauſe there is both more room to retrench in, and alſo becauſe there may be made retiring Flanks, which add very much to the Strength of a Place.

7. The *Line of Defence* ought never to exceed Point-blank Musket-ſhot, which is about 120 or 125 Fathoms.

8. The *Baſtions* that are not too little, nor yet too exceſſively big, are to be preferred before others; and the Angle of a Baſtion ſhould not exceed 100, nor be leſs than 60 Degrees.

9. The greater the *Angle* that is made by the *outward Polygon* and the Face ſhall be, the greater is the Defence of the Face.

10. Whatſoever incloſes a durable Fortification, muſt be either Flank, Face, or Curtain; and built ſo well, that the firſt Diſcharge of the Cannon may not be able to pierce through it.

11. 'Tis impoſſible to fortify a Triangle after the common Way, becauſe the Angle of the Gorge is always leſs than 90 Degrees.

12. The acuter the Angle at the Centre is, the Place is by ſo much the ſtronger, becauſe it will have the more Sides.

13. In a *Regular Fortification* the Face muſt never be leſs than half the Curtain; and the Faces of the Baſtion ought to be defended by the ſmall Shot of the oppoſite Flanks.

14. *Dry Trenches* are preferable to thoſe filled with Water, eſpecially in great Places, where Sallies, Retreats, and Succours are frequently neceſſary; but in ſmall Fortreſſes, *Water Trenches* that cannot be drained are beſt, becauſe there is no need of Sallies, Succours, &c.

The Explanation for the Plate of Fortification.

A *A Single Baſtion.*

B *A Double Baſtion* or *Cavalier*, to overlook the Enemy's Baſtions, and to ſcour their Trenches.

C *A Flatt Baſtion*; which is made when the Line of Defence is too long; *i. e.* exceeds 150 Fathom, which is the Diſtance a Musket will be ſure to do Execution. Wherefore this *Platt Baſtion* is placed in the middle of the Curtain.

D *A Half Baſtion* placed on the Side of a River.

E *A Baſtion Tenailed*; when the Angle of the Baſtion is leſs than 70 Degrees.

F *A Ravelin* which covers the Gates, Bridges and Curtains. Sometimes theſe Ravelins have Flanks made to them, as G.

G *A Ravelin* with Flanks.

H *An Half-Moon*, made to cover the Flanked Angle of the Baſtion. The *Gorges* of *Half-Moons* are circular.

I *Counter-Guard*, which are raiſed inſtead of *Half-Moons.*

K *A Single Tenaille.*

L *A Queue D'yronde*, or *Swallow's-Tail*: So called, becauſe its Sides inſtead of being parallel, open or ſpread towards the Head, and grow narrow at the *Gorge.*

M *A Bonnet a Preſtre*, or *Prieſt's-Cap*: Some call them *Double Tenailles.* But they differ from a *Tenaille*, becauſe its Sides are not parallel, but ſpread or open out towards the Campaign like a *Swallow's Tail.* This Work hath two Angles *Saillant*, and two Inwards.

N *A Horn-Work*, whoſe Head is fortified with two Demi-Baſtions, or *Epaulments*, join'd by a Curtain, and cloſed by parallel Sides ending at the *Gorge* of the Work. Theſe *Horn-Works* are uſed to cover the Gates, *&c.* inſtead of *Tenailles.*

N 2, *A Horn-Work*, whoſe Sides are not parallel.

O *A Crown-Work*, whoſe Deſign is to cover ſome large Spot of Ground to defend a Riſing-Ground, or to defend the Head of a Camp that is intrenched: 'Tis the largeſt of all Outworks, having a large *Gorge*, and two Sides, ending towards the Campaign in two Demi-Baſtions; each of which joins by a Curtain, to an entire Baſtion that is at the Head of the Work.

P *Tenailles* to defend the Ditch.

Q *An Half-Moon* covered with two *Counter-Guards* R R, to make it the ſtronger.

S S *Places of Arms* on the *Counterſcarp*, being open Spots of Ground for the Garriſon to Rendezvous on an Alarm, *&c.*

T The *Ditch.*

T T, *&c.* The *Counterſcarp*, or *Covered-Way.*

g g, &c. The *Glacis.*

V *A Retrenchment* within or behind a Breach; as X.

W *A Place* for a *Magazine.*

l l l Palliſades.

a a Redoubts.

b b b Batteries.

c Lines of Communication.

d d Trenches, by which the Approaches are carried on.

e Mine under the Glacis and Covered-Way of the *Horn-Work.*

f A Lodgment at the Foot of the *Glacis.*

Explanation of the Profile.

r a	The Baſe of the *Rampart*	70 Feet
t s, q o	Its Height	16
r s	The Inward *Talu*	16
o a	The Outward *Talu*	8
l q	The Baſe of the *Parapet*	21
Z d	The Inward Height	6
n p	The Outward Height	4
n q	The Outward *Talu* of the *Parapet*	2
o d	The Inward	1
y l	The Breadth of the *Foot Bank*	3
y x	The Height of it	1½
t y	The *Terre-Plane.*	25
a e	The *Berme*	3 Feet
e g	The Breadth of the Moat	112
i f	Its Depth	12
f h	Its Breadth at the Bottom	88
e s k g	The *Talus's*, each	12
c g	The little Ditch at the Bottom of the Moat	18
q w	Its Depth	5
g c	The *Covert-Way*	18
c d	The Seat of the *Parapet*	60
c f	Its Height	6
f d	The *Glacis*	

FORTIFICATION: Writers on this Subject.

Sir *Jonas Moor*'s Modern Fortification. *London*, 1673. 8*vo*.

Nouvelle Maniere de Fortifier les Places, par M. Blondel. Hague, 1684.

La Grand Art d' Artillerie, par Caſimir Symyenwicks. Frankfort, 1676.

Les Fortifications d' Antoine de Ville. Lyon, 1618.

Fortificationi di Buono ajuto Lorini. Venet. 1597.

Corona Militari d' Artiglieria di Aleſſandro Capo. Ibid. 1602.

F. L. Vegetius & alii de Re Militari, cum Fig. Paris, 1535.

Cohorn's Fortification, *Eng.* by Cap. *Savery.*

Blondell's Art de Jetter des Bombes.

Anderſon's Gunnery.

Fortification and Military Diſcipline, by Cap. *John Steed.*

Norwood's Fortification.

L' Arte de Fortifier, par M. Dechales.

L' Arte de Fortification, par M. Ozanam.

FORTINGLES, the ſame with *Farthingdell*; *i. e.* the fifth Part of an *Acre*, *Penny*, &c.

FORTINS, or *Field-Forts*, are Sconces or little Fortreſſes, whoſe *flank'd Angles* are generally diſtant one from another 120 fathom, but their extent and figure are different, according to the Situation or Nature of the Ground; ſome of them having whole Baſtions, and others only Demi-Baſtions. They are made uſe of only for a Time, either to defend the Lines of *Circumvallation*, or to guard ſome Paſſage or dangerous Poſt.

FORTITUDE, is that Virtue which enables us to perſevere in doing well, notwithſtanding any Dangers, Obſtacles, or Difficulties, we may meet with in the Performance of what we know to be our Duty.

FOSSA, is, according to ſome Anatomiſts, the Term for the middle Part of the *Cervix*, or hinder Part of an Humane Neck. The upper Part being called *Lophia*, and the lower *Epimis*.

FOSSA *Magna*, FOSSA *Navicularis*, [in *Anatomy*,] is an oblong Cavity forming the inſide of the *Pudendum Muliebre*, preſenting it ſelf upon the opening the *Labia*, in the middle whereof are the *Carunculæ Myrtiformis*.

FOSSATORUM *Operatio*, was antiently the Service of Work and Labour done by Inhabitants and adjoining Tenants for Repair and Maintenance of the Ditches round the City or Town, for which ſome compounded, paying a Duty called *Foſſagium*. L.

FOSSILS: All Bodies whatever that are dug out of the Earth, are by Naturaliſts commonly treated of under this general Title of *Foſſils*: But theſe may be diſtinguiſhed into two Claſſes.

Firſt, Such as are Natives of the *Earth*: Or,

Secondly, Such as are *Adventitious*, and repoſited in the Earth by the *Univerſal Deluge*, or by ſome other means.

Of which latter Sort are the *Exuviæ* of *Sea* and *Land Animals*; the *foſſil-Shells*, *Bones*, *Teeth*, &c. which are plentifully found in the Earth, and by ſome *Writers* have been erroneouſly thought a ſort of Stones that are peculiar, and as they ſpeak, *ſui Generis*.

The following *Table* of ſuch *foſſils* are as *Natives* of the Earth, conſiſts only of the *Heads* and *Titles* extracted out of a *Natural Hiſtory* of theſe *Bodies*, compoſed by Dr. *Woodward*, and founded wholly upon *Experiments* and *Obſervations* made upon them.

In this *Table* they are rank'd and diſtributed according to their *Natural Properties*, and their *Relations* to each other.

Chap. 1. EARTHS.

The *Engliſh*, *Bohemian*, and the *Armenian* Boles.
Umbre. Ochre, yellow and red.
Tripela. Terra Militenſis.
Chalk. Steinomarga, or Lac Lunæ.
The common black Vegetable Earth.
Loam. Marle. Clay.
Terra Lemnia. Tobacco-pipe Clay.
Argilla, or Potter's Earth. Porcellana.
Steatites, or Soap-Earth. Fuller's Earth.

Chap. 2. STONES.

Sect. 1. *Thoſe that are found in larger Maſſes.*

Lapis Molaris, or Milſtone. Grind-ſtone.
Sand-ſtone, or Saxum-arenarium. Free-ſtone.
Saxum calcarium, or Lime-ſtone. Whetſtone.
Ragſtone.
Lapis fiſſilis, or Slate.
Hone. Oilſtone. Touchſtone.
Alabaſter. Marble.
Ophites. Porphyrites.

Sect. 2. *Stones found in leſſer Maſſes.*

Art. 1. *Thoſe that do not exceed Marble in Hardneſs.*

§. 1. *Thoſe that are of an indeterminate Figure and Texture.*

The coarſer gritty Pebbles.
Lapis Violaceo Odore.

§. 2. *Thoſe that are of an indeterminate Figure, but of a regular Texture.*

Gypſum Striatum, *Engliſh* Talk.
Amianthus ſive Aſbeſtos. Alumen plumoſum.
Talk.

§. 3. *Thoſe that are commonly of determinate Figures*

Selenites. Lapis Specularis, or *Muſcovy* Glaſs.
Ludus Helmontij, or the Waxen Vein.
Lapidus Tubulis referti, or the Piped Waxen Vein.
Belemnites, or the Thunder-ſtone.
The Foſſil Coralloid Bodies, ſimple and branched, and the Stones related to them, *e. gr.*
Stelechites. Mycetites. Porpites.
Aſtroites The Honey-comb-ſtone.
Fluor or Spar, Stalactites, Stalagmites.
Oſteocolla.

Art. 2. *Stones found in leſſer Maſſes, that do exceed Marble in Hardneſs.*

Thoſe comprehended under this ſecond Article, are uſually called *Gems*, or *Precious Stones*. The whole Tribe of theſe are exhibited here; and indeed none but them, excepting Pebbles and Flints, which are rank'd of courſe along with the Agate-kind, to which they really belong.

§. 1. *Thoſe that are Opaque.*

Subdiviſion 1. *Of one Colour.*

The Turcois. The Nephritick Stone. The Malachite. The two laſt are ſometimes a little variegated.

Subdiviſion 2. *Of different Colours mix'd in the ſame Body.*

Lapis Lazuli. Heliotropium, or Blood-ſtone.
The Jaſper.

§. 2. *Semi-pellucid Stones.*

Subdiviſion 1. *With Colours changeable, according to the different Poſition of the Stone to the Light.*

Oculus Cati. The Opal.

Subdiviſion 2. *With Colours permanent.*

The finer Pebbles and Flints, Agates. The Chalcedony.
Mocho-ſtones. The Oculus Beli. Onyx, and Sardonyx.
The white Cornelion. The red Cornelion, and the Beryl.

§. 3. *Stones Diaphanous, with Colours.*

§§. 1. *Yellow, or partaking of it.*
The Topaz. The Jacinth.
§§. 2. *Red, or partaking of it.*
The Granate. The ſeveral Sorts of Rubies.
The Amethyſt.
§§. 3. *Blue, or partaking of it.*
The Saphire. The Water Saphire.
The Aquemarine.
§§. 4. *Green, or partaking of it.*
The Emerald. The Chryſolite.

§. 4. *Stones Diaphanous, and without Colours.*

Cryſtal. The Pſeudo adamantes.
The white Saphire. The Diamond.

Chap. 3. SALTS.

Foſſil or Rock Salt. Sal Gemmeum.
The Tincal of *Perſia.* The Natron of *Egypt.*
Nitre, or Salt Petre.
Alum. Vitriol.

Chap. 4. BITUMINA.

§. 1. *Liquid.*

Naptha. Petroleum. Oleum terræ Barbadenſis.

§. 2. *Solid.*

Succinum, or Amber. Bitumen. Piſſaſphalton.
Gagates, or Jet. Kanal. Coal.

Chap. 5. METALLLICK MINERALS.

Mercury. Cinnabar, the Mineral out of which 'tis drawn. Arſenick.
Sulphur. Pyrites, Marcaſita. Cobalt.
Lapis Calaminaris. Antimony.
Biſmuth, or Tin-Glaſs. Speltre, or Zink.
Nigrica fabrilis Mereti, or Black Lead.

Chap. 6. METALS.

Tin. Lead. Silver. Gold.
Copper. The Lapis Armenius is a Copper-Ore.
Iron. The Hæmatites is an Iron Ore. There is alſo a little Iron in the Loadſtone. Manganeſe, Emery, the Ætites ferruginoſa, the Mineral Bezoar, the Geodes, and the Enhydros.

Native FOSSILS, are thoſe which may be properly call'd *Foſſils*, and are ſtrictly defin'd to be ſenſible Bodies generated and growing in and of the Earth; the conſtituent Parts of which are ſo ſimple and homogeneous, that there is no apparent diſtinction of Veſſels and Juices between the part and the whole; and are either *Simple* or *Compound.*

Simple Foſſils are ſuch, the Parts of which, however they may be divided, are all of the ſame nature; *i. e.* of the ſame Gravity, Magnitude, Figure, Hardneſs, and Mobility. As Quickſilver, which however it be divided, is always found the ſame.

Compound Foſſils, are ſuch as are capable of being divided into different or diſſimilar Parts; as *Antimony*, which may by Fire be reſolved into a metalline Part; and Sulphur.

Adventitious Foſſils, } include the ſubterraneous Exuviæ of the Sea.
Foreign Foſſils, }

FOTMEL, [in *Old Times*,] was a Weight of Lead, containing ten Stone, or, at that time, ſeventy Pounds; as appears from the *Cartul. St. Albani*, *MS.* in the *Cotton* Library.

FOTUS, the ſame with *Fomentum.*

FOVEA *Cordis*, the ſame with *Anticardium.*

FOUCADE, the ſame with *Fougade.*

FOUGADE, or *Fougaſs*, is a ſmall Mine dug in form of a Well, in a Place ready to be gained by the Enemy, ſo that when they have made themſelves Maſters thereof, it is ſprung like a Mine by the means of a Saucidge.

They are alſo prepar'd under a Work which is to be blown up, and are charged with Barrels or Sacks of Powder cover'd with Earth.

FOUL, a Word uſed at Sea in two Senſes; when a Ship has been long untrimmed, ſo that Graſs, Weeds, Barnacles, or Perewincles, ſtick or grow to her Sides under Water, ſhe is then ſaid to be foul. They ſay alſo a Rope is foul, when it is either tangled in it ſelf, or hindred by another, ſo that it cannot run or be haled.

FOUL-WATER: A Ship is ſaid to make *foul-Water*, when being under Sail, ſhe comes into ſuch Shole or ſhallow Water, that though her Keel do not touch the Ground, yet ſhe comes ſo near it, that the Motion of the Water under her raiſeth the Mud from the Bottom, and ſo polluteth or fouleth the Water.

FOUNDAY, is a Word uſed in the Iron Works, for the Space of ſix Days; in which time they uſually make about eight Tun of Iron.

FOUNDER: A Ship is ſaid to *founder* at Sea, when by any extraordinary Leak, or by a great Sea breaking in upon her, ſhe is ſo filled with Water, that ſhe cannot be freed of it, nor is ſhe able to ſwim under it, but ſinks with the Weight thereof.

FOUNTAIN. *Conſtruction of an Artificial Fountain, playing by the Spring, or Elaſticity of the Air.*

A Veſſel, proper for a Reſervoir, as *A B*, Tab. *Hydraulicks Fig.* 17. is provided of Metal, Glaſs, or the like, ending in a ſmall Neck *c*; a top thro' this Neck a Tube is put, *c a*, traverſing the middle of the Veſſel, till its lower Orifice, *d*, nearly, but not abſolutely, reach the bottom of the Veſſel: The Veſſel being firſt half fill'd with Water, the Neck is ſo contrived, that a Syringe, or condenſing Pipe, may be ſcrewed upon the Tube; by means whereof, a large Quantity of Air may be intruded thro' the Tube into the Water; out of which it will diſengage it ſelf, and emerge into the vacant Part of the Veſſel, and lie over the Surface of the Water, *C D*.

Now, the Water here contain'd, being thus preſs'd by the Air, which is *e. gr.* twice as denſe as the external Air; and the elaſtick Force of Air being equal to its gravitating Force, the Effect will be the ſame as if the Weight of the Column of Air over the Surface of the Water, were double that of the Column preſſing in the Tube; ſo that the Water muſt of neceſſity ſpout up thro' the Tube, with a force equal to the Exceſs of Preſſure of the included, above that of the external Air: See *Air*.

Conſtruction of an Artificial Fountain, playing by the Preſſure of the Water.

Having the Conveniency of a Fund, or Reſorvoir of Water, in a Place conſiderably higher than that where the *Fountain* is to be, (whether that Fund have been plac'd there by Nature; or whether it have been rais'd for the Purpoſe, by a proper Engine; as a Pump, Syphon, Spiral Screw, or the like) from the Reſervoir lay vertical Tubes for the Water to deſcend thro'; and to theſe vertical Tubes, fit other horizontal ones, under Ground, to carry the Water to the Place where the *Fountain* is to play.

Laſtly, from theſe horizontal Tubes erect other vertical ones, by way of Ajutages, Jets, or Spouts; their Altitude being much leſs than that of the Tubes whereby the Water was brought to the horizontal ones.

Then will the Water, by the Preſſure of the ſuperincumbent Column, be ſpouted up at the Jets, and that to the height, or level of the Water in the Reſervoir; and this, howſoever any of the Tubes be bent or incurvated: The Demonſtration hereof, ſee under *Fluids*.

Thus may Water be ſpouted to any given height at pleaſure; the Tubes may be ſo proportioned, as to yield any given Quantity of Water, in a given time; or ſeveral Tubes of the ſame *Fountain* may be made to yield Water in any given Ratio: Or, laſtly, different Tubes may project the Water to different Altitudes. Rules for all which, the Reader will find among the Laws of *Fluids*.

Theſe aerial, or aquatic *Fountains*, may be applied in various manners; ſo as to exhibit various Appearances: From theſe alone, ariſe the greateſt Part of our artificial Water-Works.

An inſtance, or two, will not be diſagreeable.

A Fountain that ſhall ſpout the Water in various Directions.

Suppoſe the vertical Tube or Spout, in which the Water riſes, to be *A B*, (Table *Hydraulicks*, *Fig.* 18.) into this fit ſeveral other Tubes; ſome horizontal, others oblique; ſome inclining, others reclining; *O P*, *M N*, *F L*, &c.

Then as all Water retains the Direction of the Aperture thro' which it is ſpouted; that iſſuing thro' *A*, will riſe perpendicularly; and that thro' *L*, *H*, *N*, *P*, *E*, will deſcribe Arches of different Magnitudes, and tending different ways.

Or thus: Suppoſe the vertical Tube *A B*, *Fig.* 19. thro' which the Water ariſes, to be ſtopp'd a-top, as in *A*; and inſtead of Pipes, or Jets, let it be only perforated with little Holes all round, or only half its Surface; then will the Water ſpin forth in all Directions thro' the little Apertures; and to a Diſtance proportional to the Height of the fall of the Water.

And hence, if the Tube *A B* be ſuppos'd the height of a Man, and be furniſh'd with an *Epiſtomium*, or Cock at *C*; upon opening the Cock, the Spectators, dreaming of no ſuch matter, will be cover'd with a Shower.

It muſt be here obſerved, that the Diameters of the Apertures, by which the Water is emitted, muſt be conſiderably leſs than thoſe of the Tubes, in which the Water is brought; leſt the Reſiſtance of the Air, and other Impediments, ſpecify'd under *fluid*, break the force of the Water.

A Fountain playing by Draught of the Breath.

Suppoſe *A B*, *Fig.* 20. Glaſs or Metal Sphere, wherein is fitted a Tube, *C D*, having a little Orifice in *C*, and reaching almoſt to *D*, the bottom of the Sphere. If now the Air be ſucked out of the Tube *C D*, and the Orifice *C* be immediately immerg'd under cold Water; the Water will aſcend thro' the Tube into the Sphere.

Thus proceeding, by repeated Exſuctions, till the Veſſel be above half full of Water; and then applying the Mouth to *C*, and blowing Air into the Tube; upon removing the Mouth, the Water will ſpout forth.

Or, if the Sphere be put in hot Water, the Air being thereby rarify'd, will make the Water ſpout as before.

This kind of *Fountain* is call'd *Pila Heronis*, or Hero's Ball; from the Name of its Inventor.

A Fountain, the Stream whereof raiſes, and plays a Braſs Ball.

Provide a hollow Braſs Ball, *A*, *Fig.* 21. made of a thin Plate, that its Weight may not be too great for the force of the Water. Let the Tube *B C*, through which the Water riſes, be exactly perpendicular to the Horizon.

Then the Ball being laid in the bottom of the Cup or Baſon *B*, will be taken up in the Stream, and ſuſtain'd at a conſiderable Height, as *A*, alternately vibrating, or playing up and down.

Hence, as the figure of the Ball contributes nothing to its reciprocal Riſe and Fall; any other Body, not too heavy, may be ſubſtituted in lieu thereof, *e. gr.* a Bird with its Wings ſtretch'd forth.

But *Note*, that as 'tis neceſſary the Globe, when on the Deſcent, ſhou'd keep the ſame preciſe Perpendicular wherein it roſe, (ſince otherwiſe it wou'd miſs the Stream, and fall downright;) ſuch a Fountain ſhou'd only be play'd in a Place free from Wind.

A Fountain which ſpouts the Water in manner of a Shower.

To the Tube wherein the Water is to riſe, fit a ſpherical or lenticular Head, *A B*, (*Fig.* 22.) made of a Plate of Metal, and perforated a-top, with a great number of little Holes.

The Water riſing with Vehemence towards *A B*, will be there divided into innumerable little Threads, and afterwards broke, and diſperſed into the fineſt Drops.

A Fountain which ſpreads the Water in form of a Cloath.

To the Tube *A B*, (*Fig.* 23.) ſolder two ſpherical Segments *C* and *D*, almoſt touching each other, with a Screw *E*, to contract or amplify the Interſtice or Chink at pleaſure.

Others chuſe to make a ſmooth even Nitch, in a ſpherical or lenticular Head, fitted upon the Tube.

The Water ſpouting thro' the Chink or Nitch, will expand it ſelf in manner of a Cloath.

Fountains wherein the Water ſpouts out of the Figures of Men, and other Animals.

Since Water may be derived or conveyed by Tubes in any Situation, and always retains the Direction of the Aperture, all here required is, to incloſe Tubes within the figures of Men, or other Animals, having their Orifices in thoſe Parts whence the Water is to ſpout forth.

From the Principles hitherto laid down, it will be very eaſy to reduce whatever relates to the furniture of *Fountains*, and the various forms Water may be put into by their means; all depending on the Magnitude, Figure, and the Direction of the Ajutages, or Apertures.

A Fountain, which when it has done ſpouting, may be turn'd like an Hour-Glaſs.

Provide two Veſſels, *L M*, and *N O*, (*Fig.* 24.) to be ſo much the bigger as the *Fountain* is to play the longer; and placed at ſo much the greater diſtance from each other, *P N*, as the Water is deſir'd to ſpout the higher.

Let *B A C* be a crooked Tube, furniſh'd in *C* with a Cock; and *F E D* another crooked Tube, furniſh'd with a Cock in *D*: In *I* and *K* are to other leſſer Tubes open at both ends, and reaching near to the bottoms of the Veſſels *N O*, and *L M*; to which the Tubes *Q R*, and *S T*, are likewiſe to reach.

If, now, a Veſſel *L M* be filled with Water, it will deſcend thro' the Tube *B A*, and upon opening the Cock *C*, will ſpout up near to the height of *K*: and after its fall again, will ſink thro' the little Tube *c*, into the Veſſel *N O*, and expel the Air thro' the Tube *Q O*; at length, when all the Water is emptied out of the Veſſel *L M*, by turning the Machine upſide down, the Veſſel *N O* will be the Reſervoir, and make the Water ſpout up thro' the Cock *D*.

Hence, if the Veſſel *L M* and *N O* contain juſt as much Water as will be ſpouted up in an Hour's time, we ſhall have a ſpouting *Clepſydra*, or Water-Cock, which may be graduated or divided into Quarters, Minutes, *&c.* as ſhewn under the Article *Clepſydra.*

A Fountain that begins to play upon the lighting of Candles, and ceaſes as they go out.

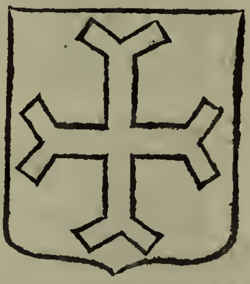
Provide two cylindrical Veſſels, *A B*, and *C D*, (*Fig.* 25.) connect them by Tubes, open at both ends, *K L*, *B F*, &c. ſo that the Air may deſcend out of the higher into the lower, to the Tubes ſolder Candleſticks, *H*, *&c.* and to the hollow Cover of the lower Veſſel *C F*, fit a little Tube; or ſet *F E*, furniſh'd with a Cock *G*, and reaching almoſt to the bottom of the Veſſels.

In *G* let there be an Aperture, furniſh'd with a Screw, whereby Water may be pour'd into *C D*.

Then, upon lighting the Candles *H*, *&c.* the Air in the contiguous Tubes becoming rarefy'd thereby, the Water will begin to ſprout thro' *E F*.

By the ſame Contrivance may a Statue be made to ſhed Tears upon the preſence of the Sun, or the lighting of a Candle, *&c.* all here requir'd being to lay Tubes from the Cavity wherein the Air is rarify'd, to ſome other Cavities near the Eyes, and full of Water.

FOURCH, [in *Law*,] ſignifies a Delay, putting off or prolonging of an Action.



FOURCHEE, [in *Heraldry*,] as a *Croſs Fourchee*, is one forked at the Ends, having its Forks compoſed of ſtrait Lines and blunt Ends, as in the figure. Tho' *Upton* repreſents it as *anchored*, the Extremities turning in a circular manner to ſharp Points.

FOURNEAU, is the *Powder Chamber*, or the *Chamber of a Mine*, which holds the Powder in Barrels or Sacks, (uſually about 1000*lb.* Weight) which by means of the *Saucidge* is fired, and ſo the Mine is ſprung.

FOURTH, a Term in *Muſick*; the ſame with *Diateſſeron*: Which ſee.

FRACTION, is a broken Number, ſignifying one or more Parts proportionally of any thing divided. It conſiſts of two Parts, which are two Numbers ſet over one another, as $\frac{5}{8}$: Of which two Numbers, that below the Line is called the *Denominator*, becauſe it denominates or ſhews the Nature or Kind of the Parts any Whole is divided into; and the Number above the Line is called the *Numerator*, becauſe it numbers or tells us how many of thoſe Parts the Fraction doth conſiſt of. Thus $\frac{5}{8}$ ſuppoſes ſome Whole to be divided into 8 equal Parts, and then that you take 5 of them, or 5 ſuch Parts.

In all Fractions, As the Numerator: Is to the Denominator:: So is the Fraction it ſelf: To that Whole of which it is a Fraction. Thus, ſuppoſe $\frac{3}{4}$ of a Pound be equal to 15*s.* then 'tis plain, 3 : 4 :: 15*s*: 20*s*.

From which general Axiom will follow theſe Corollaries.

1. That there may be infinite Fractions of the ſame Value one with another; for there may be infinite Numbers found, which ſhall have the Proportion one to another as 3 has to 4.

2. When the Numerator is leſs than the Denominator, the Fraction is leſs than the Whole, and conſequently is what they call a *Proper Fraction.*

3. But when the Numerator is either equal to, or greater than the Denominator, the Fraction is

called *Improper*, becauſe 'tis equal to, or greater than the whole. Thus $\frac{4}{4}$ is equal to 1, and $\frac{5}{4}$ is equal to 1 and $\frac{1}{4}$.

Fractions are either *Single* or *Compound*.

Single Fractions are ſuch as have but one Numerator and one Denominator, as $\frac{3}{4}$, $\frac{5}{9}$, $\frac{11}{22}$.

Compound Fractions, or Fraction of Fractions, are ſuch as conſiſt of more than one Numerator and one Denominator, as $\frac{1}{2}$ of $\frac{3}{4}$ of $\frac{5}{8}$, and are always connected by the Word *Of*.

Reduction of Fractions.

I. *To reduce Fractions to their leaſt Terms.*

Rule 1. If both Numerators and Denominators are even Numbers, divide each by 2 as long as you can, till an odd Quotient ariſeth, and then have recourſe to the 4th *Rule*, which is General.

Thus, this Fraction $\frac{884}{1248}$ will by Biſſection be reduced to $\frac{221}{312}$, and $\frac{8}{48}$ will be reduced to $\frac{1}{6}$.

Rule 2. If both end in Cyphers, cut off an equal Number of them from both, and then proceed by the other *Rules*.

Thus, $\frac{2400}{9000}$ will become $\frac{12}{45}$.

3. If both Numerator and Denominator end in 5, or one in 5, and the other in 0, they may be always reduced into leſſer Terms, by dividing each by 5.

Thus, 5) $\frac{475}{595}$ (= $\frac{95}{170}$, and 5) $\frac{265}{480}$ (= $\frac{75}{96}$.

4. When by none of the former *Rules* you can reduce them wholly, try this Method, which is General; that is, find the greateſt Number that will divide both *Numerator* and *Denominator* without any Remainder; and then dividing both Parts of the Fraction by that Number, take the Quotients for a new Fraction, which ſhall be of the ſame Value and in its leaſt Terms.

The *Greateſt Common Diviſor* to any two Numbers is thus found:

Divide the Greater by the Leſſer, and then divide the laſt Diviſor by the Remainder, and ſo continually till nothing remain; and then take the laſt Diviſor for the *Greateſt Common Meaſure* ſought.

If after all Trials ſtill there remains Unity, then the Fraction cannot be reduced farther.

Thus, in reducing $\frac{91}{117}$ into its leaſt Terms, 'twill be found to be $\frac{7}{9}$, the *Greateſt Common Diviſor* being 13.

```
91) 117 (1
     91
   ------
    26) 91 (3
        78
      ------
       13) 26 (2
           26
         ------
           00
```

But this *Rule* may alſo be very much abridg'd by this Method, *viz. When you find any Remainder to be more than half the laſt Diviſor*, ſubtract it from the Diviſor, and divide that Diviſor by the *new Remainder* found by ſuch Subtraction: As ſuppoſe you were to find the *Greateſt Common Diviſor* in this Fraction $\frac{744}{899}$.

```
744) 899 (1
     744
   ------
    155) 744 (4
         620
       ------
         124
    155
    124
   ------
     31) 155 (5
         155
       ------
          0
```

Which laſt Remainder 124 being more than half 155, I ſubtract it from it, and there remains 31; which dividing 155 without Remainder, I find to be the *Greateſt Common Diviſor* to thoſe two Numbers.

II. *To find the Value of any* Fraction *in the known Parts of its Integer.*

As ſuppoſe it was requir'd to know what is $\frac{9}{16}$ of a Pound.

Multiply (9) the Numerator by (20) the Number of known Parts of the next inferior Denomination, and divide the Product by (16) the Denominator of the given Fraction; the Quotient will be 11 *s.* and the Remainder (4) being multiplied by (12) the Number of known Parts in the next inferior Denomination; and dividing the Product (48) (by 16) as before, the Quotient will be 3 *d.* So that you find that $\frac{9}{16}$ of a Pound is 11 *s.* and 3 *d.*

```
    20
     9
  ------
16) 180 (11 s.
  ------
    20
  ------

    12
  ------
16) 48 (3 d.
  ------
    00
```

III. *To reduce a mix'd Number (as* $4\frac{11}{22}$*) into an Improper Fraction of the ſame Value.*

Multiply (4) the Integer Part, by (12) the Denominator of the Fraction; to the Product (48) add the Numerator; the Sum (59) ſet over the former Denominator (12.) Thus $\frac{59}{12}$ will be an *Improper Fraction* of the ſame Value with the mix'd Number given; for 12 now divides that Product which before it help'd to produce, and therefore the Value muſt be the ſame as before.

IV. *To reduce a whole Number into an Improper Fraction.*

1. If no Denominator be aſſign'd, draw a Line under it, and ſet Unity beneath that Line, and 'tis done. Thus, if 8 were given to be reduc'd, write it in this Manner, $\frac{8}{1}$.

2. But if there be a Denominator (as ſuppoſe 3) given, multiply (8) the given Number by (3) the

aſſign'd Denominator, and ſet the Product over (3) and 'tis done, and ſtands thus, $\frac{24}{3}$; for the Number 8 is multiplied by 3, and then that Product divided by 3, which makes it of the ſame Value now as before.

V. *To reduce an Improper Fraction into its equivalent mix'd Number, as ſuppoſe* $\frac{59}{12}$.

Divide (59) the Numerator by (12) the Denominator; the Quotient ($4\frac{11}{12}$) will be the mix'd Number ſought.

VI. *To reduce a Compound Fraction into a Single one.*

Multiply all the Numerators continually for a new Numerator, and all the Denominators for a new Denominator.

Thus, $\frac{1}{2}$ of $\frac{3}{4}$ of $\frac{5}{8}$ reduced, will be $\frac{15}{64}$.

VII. *To reduce Fractions of different Denominations to others of the ſame Value, having the ſame common Denominator.*

1. Reduce them always to their leaſt Terms.

2. Then multiply all the Denominators for a common Denominator; and multiply continually the Numerator of each Fraction into all the Denominators except its own, and that will give new Numerators to be ſet over the common Denominator.

Thus, if it was requir'd to reduce $\frac{2}{3}$, and $\frac{4}{7}$, and $\frac{5}{6}$, into one common Denominator:

I ſay, 3 into 7, into 6, produces 126 for a common Denominator.

Then $2 \times 7 \times 6 = 84$, therefore $\frac{2}{3} = \frac{84}{126}$.
And $3 \times 4 \times 6 = 72$, therefore $\frac{4}{7} = \frac{72}{126}$.
Alſo $5 \times 7 \times 3 = 105$, therefore $\frac{5}{6} = \frac{105}{126}$.

Addition in Vulgar Fractions.

1. If the Fractions propoſed have equal Denominators, only add the Numerators, and ſet the Sum over the common Denominator.

Thus, $\frac{5}{16} + \frac{9}{16} = \frac{14}{16}$.

2. But if they have not a common Denominator, they muſt be reduced to others of the ſame Value, that have a common Denominator; then add as in the firſt *Rule*.

3. If Compound Fractions are given to be added, they muſt firſt be reduced to ſingle ones of the ſame Value, and then they will fall under theſe two *Rules* foregoing.

4. When Fractions of different Denominations are given to be added, they muſt be reduced into Fractions of the ſame Denomination, (or which have the ſame common Integer) by the *Rule* for reducing Compound Fractions.

Thus, if $\frac{6}{8}$ of a Pound, $\frac{2}{3}$ of a Shilling, and $\frac{4}{7}$ of a Penny, were propoſed to be added together, they muſt all be brought into the Denomination of Pounds.

Thus, $\frac{2}{3}$ of a Shilling is $\frac{2}{3}$ of $\frac{1}{20}$ of a Pound, (which reduced, is $\frac{2}{60}$ of a Pound:) So $\frac{4}{7}$ of a Penny is $\frac{4}{7}$ of $\frac{1}{12}$ of $\frac{1}{20}$ of a Pound; (which being reduced, is $\frac{4}{1680}$) then thoſe two Fractions $\frac{2}{60}$ and $\frac{4}{1680}$ may be added by the ſecond *Rule*.

5. *To add mix'd Numbers.*

1. Add the Integers in both Numbers together, then add the fractional Parts, and if their Sum be a proper Fraction, only annex it to the Sum of the Integers.

2. But if it be an improper Fraction reduce it to its equivalent mix'd Number; and adding the integral Part to the firſt Sum of the Integers, ſet the remaining fractional Part after the Integers, and 'tis done.

Thus, $5\frac{2}{3} + 4\frac{1}{2} = 10\frac{1}{6}$.

Subtraction of Vulgar Fractions.

1. If they have a common Denominator, ſubtract the leſſer Numerator from the greater, and ſet the Remainder over the common Denominator.

Thus, from $\frac{9}{16}$ take $\frac{5}{16}$, and there remains $\frac{4}{16}$.

2. If they have not a common Denominator, they muſt be reduced to Fractions of the ſame Value, having a common Denominator; and then as in the firſt *Rule*.

Thus, $\frac{6}{7} - \frac{2}{5} = \frac{30}{35} - \frac{14}{35} = \frac{16}{35}$.

3. To ſubtract a whole Number from a mix'd Number, or one mix'd Number from another.

Reduce the whole or mix'd Numbers to improper Fractions, then proceed as in the firſt or ſecond *Rule*.

N. B. This *Rule* is General; yet there are particular *Rules*, which in ſome Caſes are more Expeditious; as follows.

Particular Rules.

1. *To ſubtract a whole Number from a mix'd.*

Subtract the whole Number from the integral Part of the mix'd Number; then to the Remainder annex the fractional Part of the mix'd Number.

Thus, 3 from $5\frac{2}{7}$, leaves $2\frac{2}{7}$.

2. *To ſubtract a Fraction from* 1 *or Unity.*

Subtract the Numerator from the Denominator, and 'tis done.

Thus, $\frac{1}{4}$ from 1, leaves $\frac{3}{4}$.

3. *To ſubtract a Fraction from any whole Number greater than Unity.*

Subtract the Fraction from Unity (by 2d) then from the whole Number given ſubtract that Unity, and place the remaining Integer before, and the fractional Part (firſt found) after it, ſo ſhall that mix'd Number be the Remainder ſought.

Thus, $\frac{2}{5}$ from 7, leaves $6\frac{3}{5}$.

4. *To ſubtract a mix'd Number from a whole Number.*

Firſt ſtubract the fractional Part from Unity, borrowed from the whole Number given, and ſet down the Remainder; then adding the Integer borrowed, to the Integers of the mix'd Number, ſubtract the ſaid Sum from the whole Number, and to the Remainder annex the fractional Part firſt found, and 'tis done.

Thus, $3\frac{1}{4}$ from 9, leaves $5\frac{3}{4}$.

5. *To ſubtract a Fraction from a mix'd Number.*

1. If the Fraction given be leſs than the fractional Part of the mix'd Number, only ſubtract the Fraction from the fractional Part, and annex the Remainders to the integer Part of the mix'd, and it is done.

Thus, $\frac{1}{4}$ from $6\frac{3}{4}$, leaves $6\frac{2}{4}$.

2. But when the Fraction given is greater than the fractional Part of the mix'd Number; ſubtract the Fraction from Unity, and add the Remainder to the fractional Part of the mix'd Number; then leſſening the integral Part of the mix'd Number by Unity, annex the fractional Part (laſt found) to it:

Thus, $\frac{7}{9}$ from $6\frac{3}{9}$, leaves $5\frac{5}{9}$.

CASE I.

6. *To ſubtract one mix'd Number from another.*

When the integral Part and fractional Part of the mix'd Number to be ſubtracted, are both leſſer than the Integers and fractional Parts of the other mix'd Numbers, only ſubtract the leſſer Integer from the greater, and the leſſer Fraction from the greater, and to the Remainder of the Integers annex the Remainder of the Fraction, and 'tis done.

Thus, $2\frac{7}{12}$ from $5\frac{9}{12}$ leaves $3\frac{2}{12}$, or $3\frac{1}{6}$.

CASE II.

When the fractional Part of the mix'd Number (to be ſubtracted) is greater than the fractional Part of the other mix'd Number.

Firſt, Subtract the greater Fraction from Unity, and add the Remainder to the fractional Part of the other mix'd Number; which Sum, as the Fractional Part of the Remainder ſought, is to be kept.

Then add Unity to the leſſer integral Part, and ſubtract the Sum from the greater integral Part, and to the Remainders annex the fractional Part before reſerved, and 'tis done.

Thus, $2\frac{3}{4}$ from $7\frac{2}{5}$, reſts $4\frac{13}{20}$.

Multiplication of Vulgar Fractions.

1. When the Fractions propoſed are both ſingle Fractions, only multiply the Numerators one by another for a new Numerator, and the Denominators for a new Denominator.

Thus, $\frac{3}{4}$ into $\frac{5}{8}$, produces $\frac{15}{32}$.

2. If one be a mix'd or whole Number, it muſt be reduced to an improper Fraction, and then proceed as in the laſt Rule.

Thus, $\frac{2}{8}$ into $5\frac{2}{3}$, gives $\frac{51}{24}$; and $\frac{4}{9}$ into $\frac{10}{1} = 40$.

N. B. In Multiplication of Fractions the Product is leſs in Value than either Multiplicand or Multiplicator; becauſe in all Multiplications, As Unity : Is to the Multiplicator :: So is the Multiplicand : To the Product; or, As Unity : Is to either Factor :: So is the other Factor : To the Product. But Unity is bigger than either Factor, (if the Fractions are proper) and therefore either of them muſt be greater than the Product.

Thus in whole Numbers, if 5 be multiplied by 8, 'twill be, As 1 : 5 :: 8 : 40; or, 1 : 8 :: 5 : 40. Wherefore in Fractions alſo, As $1 : \frac{3}{4} :: \frac{5}{8} : \frac{15}{32}$; or, As $1 : \frac{5}{8} :: \frac{3}{4} : \frac{15}{32}$.

But 1 is greater than either $\frac{3}{4}$ or $\frac{5}{8}$: Wherefore either of them muſt be bigger than $\frac{15}{32}$.

Diviſion in Fractions.

1. When the Fractions propoſed are both ſingle, multiply the Denominator of the Diviſor by the Numerator of the Dividend; the Product is the Numerator of the Quote.

Then multiply the Numerator of the Diviſor, by the Denominator of the Dividend; the Product is the Denominator of the Quotient.

Thus, $\frac{3}{5}$) $\frac{4}{9}$ ($\frac{20}{27}$.

2. If either Dividend, Diviſor, or both, be whole or mix'd Numbers, reduce them to improper Fractions; and if they be Compound Fractions, reduce them to Simple ones, and proceed as in the firſt Rule.

N. B. That in Diviſion of Fractions, the Quotient is always greater than the Dividend; becauſe in all Diviſion, As the Diviſor : Is to Unity :: So is the Dividend : To the Quotient; as if 3 divide 12, 'twill be, As 3 : 1 :: 12 : 4. Now 3 is greater than 1, wherefore 12 muſt be bigger than 4: But in Fractions, As $\frac{3}{5} : 1 :: \frac{4}{9} : \frac{20}{27}$; where $\frac{3}{5}$ is leſs than 1; wherefore $\frac{4}{9}$ muſt alſo be leſs than $\frac{20}{27}$.

FRACTIONS, Beſides the common one, given before, there is alſo another Notion of a Fraction, which is very neceſſary to be underſtood, becauſe it will be of uſe to ſhew the Reaſon of many of the vulgar Rules and Operations in Fractions. Thus, ſuppoſe $\frac{3}{4}$ of 20 *s.* or of a Pound *Sterling*, were the Fraction, this Fraction, inſtead of three quarters of one Pound, may be conſider'd as a fourth Part of three Pounds: That is, by taking as many of the Integers as the Numerator expreſſes (*viz.* 3.) and dividing them by 4, the Denominator; for then a Quotient of the ſame Value will ariſe, (for 4) 60 *s.* (15 *s.*) And this ſhews you the Reaſon of that manner of Expreſſion which is uſed by Geometers and Algebraiſts about Fractions; who read $\frac{a}{b}$ thus, *a* divided by *b*.

FRACTIONS *Decimal*: See *Decimal.*

FRACTIONS *Sexageſimal*: See *Sexageſimal.*

FRACTIONS *in Algebra.* A Fraction is a broken Number or Quantity, expreſſing the Parts of ſome Integer. It conſiſts of two Parts, with a Line of Separation placed between them. Of which, that above the Line is called the *Numerator*, becauſe it enumerates or tells you how many of the Parts of the Integer the Fraction contains: And that below the Line is call'd the *Denominator*; becauſe it denominates or expreſſes the Nature of the Parts the Integer is ſuppoſed to be divided into: Thus,

Suppoſe $a = 3$ and $b = 4$, then will $\frac{a}{b}$ or $\frac{3}{4}$ be a Fraction, expreſſing that ſome Integer being divided into 4 Parts or Quarters, there is taken 3 of them, or 3 Quarters.

A Fraction is either *Proper*, when the Numerator is leſs than the Denominator, as $\frac{3}{4}$: Or *Improper*, when the *Numerator* is equal to it, or greater: As $\frac{4}{4}$ or $\frac{4}{3}$ are improper Fractions; becauſe

cauſe one expreſſes the whole Integer, and the other more than the Integer; however 'tis often of good Uſe to expreſs Quantities after this Way.

The Operations about Algebraick Fractions, or Fractions expreſt by Letters, are much of the ſame Nature with thoſe in common Arithmetick.

I. All Fractions ought firſt to be reduc'd to their loweſt Terms; which is done by dividing both Numerator and Denominator, by their greateſt common Diviſor; that is, the greateſt Quantity which can divide both. For then the Quotient will be a Fraction of the ſame Value as the former, but in the ſmalleſt Terms that can be. Thus, $\frac{3aa}{6a}$, by dividing both Parts by $3a$, will be brought down to $\frac{a}{2}$ or $\frac{1}{2}a$. And $\frac{4a^3}{6a^4}$ being divided by its greateſt common Diviſor $2a^4$, will be reduc'd to $\frac{2aa}{3}$.

$$\begin{array}{c}4z\\4z\end{array}\Big) \frac{36zz}{4bz+16dz} \Big(\frac{9z}{b+4d}$$

And this may moſt times be done by inſpection, by caſting out of both Numerator and Denominator ſuch Letters as are multiplied into both of them; as in theſe Examples.

But ſuch greateſt common Diviſor may be found in all Caſes where the Eye cannot readily diſcover it, by dividing the Denominator by the Numerator, and the laſt Diviſor by the Remainder, if any be; and ſo on, 'till there come to remain nothing: And then that laſt Diviſor is the greateſt common Meaſure. But if Unity, or 1, remain at laſt, then the Fraction was in its loweſt Terms at firſt, and cannot be reduc'd to any ſmaller Terms. This Practice is the ſame as in Vulgar Fractions; and you have an Example of it in *Species* in *Ward's* Algebra, *Chap.* 4.

II. To reduce any Integer, as b or $a+c$, to the form of an improper Fraction, draw the Line of Separation, and under it write 1, then it will ſtand $\frac{b}{1}$ or $\frac{a+c}{1}$, which, tho' in the form of Fractions, are not alter'd, becauſe 1 neither multiplies nor divides.

If a Denominator, as d, were given: Firſt multiply the given Integer by ſuch Denominator, and then write the Denominator under the Product. Thus,

$$\frac{db}{d} = b, \text{ and } \frac{da+dc}{d} = a+c.$$

III. To reduce Fractions of different Denominators, to others of the ſame Value that ſhall have a common Denominator; (which Operation muſt always precede Addition and Subtraction in Fractions.) You muſt firſt bring the Fractions down as low as you can; (by *Rule* 1.) then multiply a-croſs the Numerator of the firſt into the Denominator of the ſecond, for a new Numerator of the firſt Fraction; then the Numerator of the ſecond into the Denominator of the firſt, for a new Numerator for the ſecond Fraction; and laſtly, Multiply the Denominators one in another, for a common Denominator. Thus, let $\frac{a+b}{d}$ and $\frac{hh}{f}$ be given, and they will by this Rule be reduced to $\frac{fa+fb}{df}$, and $\frac{dhh}{df}$; Fractions in Value equal to the former.

The Reaſon of which is plain; for each Fraction is multiplied and divided by the ſame Quantity or Letter, and therefore muſt retain the ſame Value as before, tho' reduc'd to another form:

$$\frac{4}{6} \qquad \frac{3}{4}$$

$$\frac{16}{24} \qquad \frac{18}{24}$$

For every Fraction being multiplied by multiplying its Numerator, but divided by dividing it; and being alſo multiplied by dividing the Denominator, and divided by multiplying it:

It follows, that each Fraction will gain as much by the multiplication of its Numerator, as it loſes by the multiplication of its Denominator. And, *Vice verſa*, in caſe of Diviſion, by one and the ſame Quantity.

If there are more than two Fractions, every Numerator muſt be multiplied continually into all the Denominators but its own; and the Denominators one into another continually for a new Denominator. *E. gr.* $\frac{a}{x}$, $\frac{b}{y}$, $\frac{c}{z}$, will be reduc'd to this form $\frac{ayz}{xyz}$, $\frac{bzx}{yzx}$, $\frac{cyx}{zyx}$, which are Fractions of the ſame Value as the former, (as is apparent by ejecting the common Letters) but reduc'd to a common Denominator.

IV. And when this is once underſtood, Addition and Subtraction in Fractions are perform'd by only adding or ſubtracting the Numerators, and ſubſcribing the common Denominator before found. Thus,

If the Fractions $\frac{a+b}{d}$ $\frac{hh}{f}$, were to be added or ſubtracted; they will ſtand, when reduc'd (by *Rule* 3.) in this form, $\frac{fa+fb+fhh}{df}$, or $\frac{fa+fb-fhh}{df}$: The former of which is the Sum, the latter the Difference, of the two given Fractions.

V. *Multiplication* in Fractions, is perform'd by multiplying the Numerators into one another for a new Numerator, and the Denominators for a new Denominator, the Fractions having been firſt reduced to their loweſt Terms. Thus,

$$\frac{a}{b} \times \frac{d}{c} = \frac{da}{bc}, \text{ and } \frac{a+b}{c} \times \frac{a-b}{d} = \frac{aa-bb}{cd}.$$

Hence, if any Fraction be multiplied by the Denominator, or by ſome Integer the ſame with it, the Numerator is the Product. As $\frac{aa}{b} \times b = aa$, for $\frac{aa}{b} \times \frac{b}{1} = \frac{aab}{b}$; which, caſting off the common Letters in both Parts, leaves aa.

Alſo, if any Fraction be to be multiplied by ſome Letter or Letters that are found in every Member of the Denominator, the Multiplication may be made only by ejecting ſuch Letters out of the Denominator: As $\frac{ab}{cd}$ multiplied by $d =$ to $\frac{ab}{c}$.

VI. *Diviſion in* Fractions, is perform'd (after *Reduction*, according to *Rule* 3.) by multiplying the Numerator of the Dividend by the Denominator of the Diviſor, for a Numerator; and the Denominator of the Dividend by the Numerator of the Diviſor, for a new Denominator: As in *Vulgar Fractions*. Thus,

$$\frac{a}{b} \Big) \frac{d}{c} \Big(\frac{bd}{ac}$$

The Reaſon of which is plain, from what was ſaid above, That a Fraction is divided by multiplying its Denominator. Thus,

$$\frac{3}{4}\Big)\ \frac{12}{16}\ \Big(\frac{48}{48}=1.$$

For to divide $\frac{12}{16}$ by $\frac{3}{4}$, is to ſeek how often 3, the Numerator of the Diviſor, is in $\frac{12}{16}$; which is done by multiplying 16 by 3, and the Anſwer is $\frac{12}{48}$: But then again, becauſe $\frac{3}{4}$ is but $\frac{1}{4}$ of 3, it will be contain'd in $\frac{12}{16}$ 4 times oftner than 3 is; and therefore, in order to bring it to a *Par*, Divide the Value of that Fraction by multiplying its Denominator by 12, and the Product 48 will be the Numerator of the Quotient.

But if it happen that the Fractions have a common Denominator, then caſt off that, and divide one Numerator by the other. Thus,

$$\frac{a}{b}\Big)\ \frac{c}{b}\ \Big(=\frac{c}{a},\ \text{and}\ \frac{b}{a}\Big)\ \frac{bb}{a}\ \Big(=b.$$

For Fractions having a common Denominator, are as their Numerators.

VII. A Mixt Quantity or Number, is that which is part Integer, and part Fraction. As $aa+\frac{b}{c}$: Such Quantities are reduc'd to the form of improper Fractions, by firſt multiplying the integral Part by the Denominator of the fractional Part; then adding the Numerator to it, and ſubſcribing the Denominator under all. Thus, the former Quantity $aa+\frac{b}{c}$ is reduc'd to this improper Fraction $\frac{caa+b}{c}$.

Every improper Fraction is reduc'd back again into its equivalent mixt Number or Integer, by dividing the Numerator by the Denominator. Thus, $\frac{caa+b}{c}$ divided by c, quotes $aa+\frac{b}{c}$; and $\frac{aa}{1}$ divided by 1, makes aa.

FRACTURA *Oſſis*, the breaking of a Bone, is a Solution of the *Continuum* in the hard or bony Parts of the Body. *L.*

FRÆNULUM, is a membranous Ligament under the Tongue, which being extended too far towards the Tip of the Tongue, hinders Children in ſucking, whence they are ſaid to be Tongue-ty'd. *L.*

FRÆNUM, is that Ligament whereby the Prepuce is tied to the lower Part of the Glans of the *Penis.* L.

FRAISES, [in *Fortification*,] are pointed Stakes fixed in Bulwarks made of Earth, on the one ſide of the Rampart a little below the Parapet. Theſe Stakes being from 7 to 8 Foot long, are driven in almoſt half way into the Earth, and preſent their Points ſomewhat ſloping toward the Field. They ſerve to prevent Scalades and Deſertion.

FRAISING *of a Battalion*, is to line the Muſketiers all round with Pikes, in caſe of their being charg'd by a Body of Horſe.

FRAME, is the Out-work of a Clock or Watch, conſiſting of the Plates and Pillars, and which contains in it the Wheels and the reſt of the Work.

FRANCHISE, [in *Law*,] is taken to be a Privilege or Exemption from ordinary Juriſdiction, and ſometimes an Immunity from Tribute: It is either Perſonal or Real; that is, belonging to a Perſon immediately, or elſe by means of this or that Place, or Court of Immunity, whereof he is either Chief, or a Member.

FRANCHISE *Royal*, is where the King granteth to one and his Heirs, that they ſhall be quit of Toll.

FRANK-ALMOIN, [in *Law*,] ſignifies a Tenure or Title of Lands or Tenements beſtow'd upon God; that is, given to ſuch People as beſtow themſelves to the Service of God, for pure and perpetual Alms.

FRANK-BANK: See *Free-Bench.*

FRANK-CHASE, is a Liberty of free Chaſe, whereby all Men (having Ground within that Compaſs) are prohibited to cut down Wood, &c. without the View of the Foreſter, tho' it be in his own Demeſns.

FRANK-FEE, [in *Law*,] is that which is in the Hands of the King or Lord of the Mannor, being ancient Demeſn of the Crown; whereas that which is in the Hands of the Tenant, is ancient Demeſn only.

FRANK-FOLD, is where a Lord hath Benefit of folding his Sheep within his Mannor for the manuring of his Land.

FRANK-FORM, is a Land or Tenement, wherein the Nature of the Fee is charged by Feoffment out of Knight's-Service for ſeveral yearly Services; and whence neither Homage, Worſhip, Marriage, nor Relief may be demanded, nor any other Service not contain'd in the Feoffment.

FRANK-LAW, is taken for the free Enjoyment of all thoſe Privileges which the Law permits to a Man not found guilty of any heinous Offence. And he that loſeth his *Frank-Law*, is ſaid to fall into theſe Inconveniencies:

Firſt, That he may never be impannelled upon any Jury or Aſſize, or otherwiſe uſed in teſtifying any Truth.

Secondly, If he have any thing to do in the King's Court, he muſt not approach thither in Perſon, but appoint his Attorney.

Thirdly, His Lands, and Goods, and Chattels, muſt be ſeized into the King's Hands; and his Lands muſt be eſtreated, his Trees rooted up, and his Body committed to Priſon.

FRANK-MARRIAGE, is a Tenure in Land Special, whereby a Man hath Land with a Woman to him and the Heirs of his Body, without doing any Service, but Fealty to the Donor.

FRANK-PLEDGE, *Franciplegium viſus Franciplegii*, was the ancient Cuſtom for the Freemen of *England*, at 14 Years of Age, to find Surety for their Truth and Fidelity to the King, and good Behaviour to their Fellow Subjects. This Surety, among the *Saxons*, was taken in their *Friborg*, *Lath*, or *Tithing-Court*; and after the *Norman Conqueſt*, it was call'd *Frank-Pledge*, and was continu'd in the *Court-Leet* of Royal Juriſdiction to be held annually on the Feaſt of St. *Michael* by *Magna Charta.*

So that to have *Viſum Franciplegii*, View of *Frank-Pledge*, was no more than to have the Privilege of holding a *Court Leet*; and this Power was determin'd by Stat. 8. of *Edward* II. and 1ſt of *Edw.* III. The Place of holding ſuch Courts was, if it were fair Weather, on ſome open Green; but if it was bad Weather, they adjourn'd to the Mannor Houſe, or to that of ſome adjoining Tenant. *Kennet P. Antiq.*

FRANK-TENEMENT: See *Free-Hold.*

FRATRAGE, FRATRAGIUM, FRERAGE, [in *Law*,] the Partition amongſt Brothers or Co-Heirs, coming to the Inheritance or Succeſſion; alſo more particularly, it is uſed for that Part of the Inheritance that comes to the youngeſt Brothers.

FREE; the Seamen ſay, The Pump *frees* the Ship, when it throws out more Water than leaks into her; but on the contrary, when it cannot throw out the Water as faſt as it leaks in, they ſay, The Pump cannot *free* her: Alſo bailing or lading out Water out of a Boat, is called, *freeing the Boat.*

FREE-BENCH, or *Frank-Bank*, [in *Law*,] ſignifies that Eſtate in Copy-hold Lands that the Wife, being eſpouſed a Virgin, hath after the Deceaſe of her Huſband, for her Dower.

FREE-HOLD, or *Frank-Tenement*, is that Land or Tenement which a Man holdeth in Fee, Fee-Tail, or at the leaſt for Term of Life; and 'tis either *Freehold in Deed*, or *Freehold in Law.*

Freehold in Deed, is the real Poſſeſſion of Lands or Tenements in Fee, Fee-Tail, or for Life.

Freehold in Law, is the Right that a Man hath to ſuch Lands or Tenements before his Entry or Seiſure.

FREEZ, FRIZE, [in *Architecture*,] a large flat Member which ſeparates the Architrave from the Cornice; of which there are as many kinds as there are Orders of Columns.

1. The *Tuſcan*: *Vitruvius* makes this Freez flat and plain, and in Height 30 Minutes. *Vignola*, in form the ſame, but 35 Minutes in Height. *Palladio* makes it convex or ſwelling, and but 26 Minutes in Height. *Scammozzi*, makes it plain, and 42 Minutes in Height.

2. The *Dorick*: *Vitruvius* and *Vignola* makes this Freez flat, only carv'd with *Triglyphs* and *Metopes*, and 30 or 45 Minutes in Height. *Palladio* and *Scammozzi*, make it like *Vitruvius*, and 45 Minutes in Height.

3. The *Ionick*: *Vitruvius* makes this Freez flat, but commonly carv'd with *Acanthus* Leaves, Lions, Men, &c. and 30 Minutes in Height. *Vignola* makes it flat, and 45 Minutes in Height. *Palladio* makes it convex or ſwelling, and but 37 Minutes in Height. *Scammozzi* makes it flat, and but 28 Minutes in Height.

4. *Corinthian*: *Vitruvius* makes this Freez flat, but carv'd with *Acanthus* Leaves, and Men, &c. and 37 Minutes $\frac{2}{3}$ in Height. *Vignola* makes it like *Vitruvius*, but 45 Minutes in Height. And *Palladio* and *Scammozzi* alſo make it like *Vitruvius*, but the former 28 Minutes, and the latter 31 $\frac{3}{4}$ Minutes in Height.

5. The *Compoſite*: *Vitruvius* makes this Freez flat, but beſet with Cartouſes, and carv'd betwixt each Cartouſe, and 52 $\frac{1}{2}$ Minutes in Height. *Vignola* makes it like *Vitruvius*, but 45 Minutes in Height. *Palladio* makes it convex or ſwelling, and but 30 Minutes in Height. *Scammozzi* makes it like *Vitruvius*, but 32 Minutes in Height.

FREEZES, are variouſly denominated from the Variety of their Inrichments.

Convex FREEZES, *Pulvinated* FREEZES, are ſuch, the Profile of which is a Curve; the beſt Proportion of which, is when drawn on an equilateral Triangle. In ſome of them the Swelling is only at the Top, as in a *Conſole*: In others at the Bottom, as in a *Balluſter*.

Flouriſhed FREEZES, are ſuch as are inrich'd with Lines of imaginary Foliages, as the *Corinthian* Freez of the Frontiſpiece of *Nero*; or elſe with natural Leaves, either in Cluſters or Garlands, or continued; as in the *Ionick*, of the Gallery of *Apollo* in the *Louvre*.

Hiſtorical FREEZES, are ſuch as are inrich'd with Baſs Relievos, Hiſtories, Sacrifices, &c. as the Arch of *Titus* at *Rome*.

Marine FREEZES, are thoſe that repreſent Sea-Horſes, *Tritons*, and other figures proper to the Sea; or Shells, Baths, Grotto's, &c.

Ruſtick FREEZES are ſuch, the Courſes of which are ruſticated, or imboſs'd, as in the *Tuſcan* Freez of *Palladio*.

Symbolical FREEZES are ſuch, as are adorn'd with the Repreſentations of Things peculiar to Religion; as the *Apparatus* of Sacrifice, &c.

FREEZING: The *Carteſians* explicate *freezing* by the Receſs, or going out of the Etherial Matter from the Pores of the Water or other Liquor; which being once done, the finer Parts are too ſmall and flexible to keep the long, ſlender, and Eel-like Particles of Water fluent, or in the form of a Liquor.

But the *Corpuſcularians* aſcribe the freezing of Water more probably, to the Ingreſs of Multitudes of cold or frigorifick Particles, as they call them, which entring the Liquor in Swarms, and diſperſing themſelves every way thro' it, do crow'd into the Pores of the Water, and hinder the wonted Agitation of its Parts, and wedge it up as it were into the hard or conſiſtent Body of Ice.

Freezing Mixture, is what is mix'd together in order to *freeze* other Bodies. Mr. *Boyle* in his Hiſtory of Cold ſhews, That not only all Sorts of Salts, whether *Alkalizate* or *Acid*, but even *Ardent Spirits*, ſuch as that of Wine; alſo Sugar and *Saccharum Saturni*, mix'd with Snow, are capable of freezing other Bodies; and the ſame Effect was alſo very eminently produced by the Mixture of Oil of *Vitriol*, or Spirit of *Nitre* with Snow, &c.

That Ice is ſpecifically lighter than the Water out of which it is by freezing made, is certain by its ſwimming in it; and that this Levity of Ice proceeds from theſe numerous Bubbles, which are produced in it by Congelation, is equally plain; but how thoſe Bubbles come to be generated in freezing, and what Subſtance they contain in them, (if they are not quite empty) is an Enquiry of great Importance, and perhaps if diſcovered, may help us much to underſtand the Nature of Cold.

Mr. *Hobbs* aſſerts, That they are occaſioned by the common Air, which intrudes into Water in its Coagulation, and ſo expands it.

But *firſt*, No ſuch Ingreſs of Air into Water appears in its Coagulation; and that it doth not get into frozen Oil is plain, becauſe that Body is condenſed by being frozen.

Secondly, Mr. *Boyle* ſhews by undoubted Experiments, That Water frozen in Glaſſes ſealed hermetically, and in Braſs Bodies or Veſſels cloſely ſtopt, hath yet been turn'd into Ice abounding with theſe Bubbles.

Thirdly, He proves alſo by Experiment, That Water kept a while in the exhauſted Receiver, till all its Bubbles were emerged and gone, being afterwards turn'd into Ice by a freezing Mixture, that Ice had ſcarce any Bubbles at all in it. Whence 'tis plain, theſe Bubbles are filled with ſome Matter which is within the Water, if they are filled with any thing: But he proves alſo by plain Experiments, that they have none, or at leaſt exceeding little true Elaſtick Air contain'd in them.

FREEZING. The true Cauſe of the Congelation of Water into Ice, ſeems plainly to be the Introduction of the frigorifick Particles into the Pores or Interſtices between the Particles of the Water; and by that means, getting ſo near to them, as to be juſt within the Sphere of one another's attracting Force; (ſee *Attraction*) and then they muſt cohere into one ſolid or firm Body. But Heat afterwards ſeparating them, and putting them into various Motions, breaks this Union, and ſeparates the Particles ſo far from one another, that they get out of the Diſtance of the attracting Force, and into the Verge of the repelling Force, and then the Water reaſſumes its fluid form.

Now that Cold and Freezing do ariſe from ſome Subſtance of a *ſaline* Nature floating in the Air, it ſeems probable from hence, That all *Salts*, and more eminently ſome particular ones, when mix'd with Snow or Ice, do prodigiouſly encreaſe the force and effects of Cold: We ſee alſo, that all *ſaline* Bodies do produce a Stiffneſs and Rigidity in the Parts of thoſe Bodies into which they enter. Microſcopical Obſervations upon Salts inform us, That the figures of ſome Salts, before they ſhoot into Maſſes, are thin double-wedg'd like Particles, which have abundance of Surface in reſpect to their Solidity, (which is the Reaſon why they ſwim in Water, when once raiſed in it, tho' ſpecifically heavier.) Theſe ſmall Points of the Salt getting into the Pores of the Water, whereby alſo they are in ſome meaſure ſuſpended in the Winter Time, (when the Heat of the Sun is not ordinarily ſtrong enough to diſſolve the Salts into a Fluid, to break their Points, and to keep them in perpetual Motion) being leſs diſturb'd, are more at Liberty to approach one another, and by ſhooting into Chryſtals of the form above-mentioned, do, by both their Extremities, inſinuate themſelves into the Pores of Water, and by that Means freeze it into a ſolid form. And we ſee, that the Dimenſions of Water are increas'd by freezing, its Particles being kept at ſome Diſtance one from another by the Intervention of the frigorifick Matter.

But beſides this, there are many little Volumes, or ſmall Parcels of Air, included at ſeveral Diſtances, both in the Pores of the watry Particles, and in the Interſtices formed by their ſpherical Figures. Now by the Inſinuation of theſe Chryſtals, the Volumes of Air are driven out of the watry Particles, and many of them uniting, from larger Volumes, which thereby have a greater force to expand themſelves than when diſpers'd, and ſo both enlarge the Dimenſions, and leſſen the ſpecifick Gravity of Water thus congeal'd into Ice And hence, ſaith Dr. *Cheyne*, (from whom this laſt Account) we may gueſs at the Manner, how Water, impregnated with *Salts*, *Sulphurs*, or *Earths*, which are not eaſily diſſolvable, may form itſelf into *Metals*, *Minerals*, *Gums*, and other Foſſils; the Parts of theſe Mixtures becoming a Cement to the Particles of Water, or getting into their Pores, change them into theſe different Subſtances. *Phil. Prin. of Nat. Rel. p. 66.*

FREEZLAND-HORSE, the ſame with *Chevaux de Freeze*.

FRESCO. Painting in *Freſco* is thus perform'd: The Colours are ground with Lime-Water, Milk, or Whey, and temper'd or mix'd together in Pots, as in Size Colouring. The Plaiſter is made of the Powder of old rubbiſh Stones mixt with burnt Flints or Lime, and Water; but the Salt of the Lime muſt be waſh'd out, by often pouring on freſh Water. Care ſhould be taken to avoid moiſt Weather, for that has great Influence upon the Walls. And to make the Plaiſter ſtick the better, they drive in Stumps of Horſe-nails, about ſix Inches aſunder. With this Plaiſter the Wall is to be laid thick, and then it muſt be let dry; and afterwards a new Layer of Plaiſter is put, of the thickneſs of an Half-Crown; and the Colours muſt be wrought with a quick free Hand whilſt it is wet; for there is no altering it after it is dry.

FRESH, [in *Sea Language*,] a freſh Gang to relieve the Rowers in the Long-Boat.

FRESH-DISSEISIN, [in *Law*,] ſignifies ſuch a *Diſſeiſin*, as a Man may ſeek to defeat of himſelf, and by his own Power, without the help of the King or Judges.

FRESH-FINE, is that which is levied within a Year paſt.

FRESH-FORCE, is a Force done within forty Days: For if a Man be diſſeiſed of any Lands or Tenements within any City or Boroughs, or *deforced* from them after the Death of his Anceſtor, to whom he is Heir, or after the Death of his Tenant for Life, or in Tail, he may within forty Days after his Title accrued, have a Bill out of the Chancery to the Mayor, *&c.*

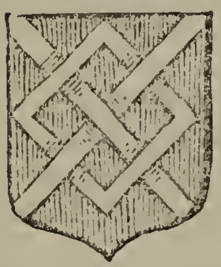
FRESH-SHOT, [in the *Sea Phraſe*,] ſignifies the falling down of any great River into the Sea, ſo that the Sea hath freſh Water a good Way from the Mouth of that River, which ſometimes by Accident is by the Deſcent of Land-Waters on a ſudden; and as this is more or leſs, they call it a great or ſmall *Freſh-Shot*.

FRESH-SUIT, [in *Common Law*,] is ſuch a preſent and earneſt Purſuit of an Offender, as never ceaſeth from the Time of the Offence committed or diſcovered, until he be apprehended: And the Effect of this in the Purſuit of a Felon is, that the Party purſuing ſhall have his Goods again; whereas otherwiſe they are the King's.

FRET, } [in *Architecture*,] a kind of Knot
FRETTE, } or Ornament, conſiſting of 2 Liſts or ſmall Fillets, variouſly interlaced or woven, and running at parallel Diſtances equal to their Breadth. It is a neceſſary Condition of theſe Frets, that every Return and Interſection be at right Angles: This is ſo indiſpenſible, that they have no Beauty if they are not ſo.

FRETT, a Bearing in Heraldry of this Figure. *Diamond*, a *Frett Topaz*: The Coat Armour formerly of *Henry* Lord *Maltrevers*, and now quartered by the Duke of *Norfolk*.

Here is but one Frett, but ſometimes the Frett is of eight Pieces, and then 'tis ſpecified to be ſo; but if it conſiſt of more, 'tis called *Frette*.



FRET-WORK, is an Inrichment of *Frets*; or a Place adorn'd with ſomething in the manner thereof. It is principally us'd in Roofs, which are fretted over with plaiſtered Work; and ſometimes to fill up and inrich flat empty Spaces.

FRIABLE, a Word uſed in reference to ſuch Bodies as will eaſily on rubbing break, crumble, or divide into ſmall Parts.

FRICTION, is a Word uſed often among Mechanicians, or the Writers on Mechanicks, for the Reſiſtance which ariſes to the Motion of the Parts of any Engine from the Matter of the Wheels, *&c.* rubbing againſt one another, or againſt any other Body.

Of the Reſiſtance ariſing from Friction of the Parts of an Engine one againſt another, Mr. *Amontons* hath a large Diſcourſe, which is printed in the *Memoires de l'Academ. Royale des Sciences*, for the Year 1699. where he makes ſeveral Experiments, gives Rules to find and calculate Tables of this Reſiſtance ariſing from *Friction*, and of that which is the Reſult of the Rigidity of Chords uſed in Pulleys, &c.

FRIGAT, is a Ship of War, uſually of two Decks, light built, and deſign'd for ſwift Sailing. When it hath but one Deck, and conſequently is of a ſmaller Size, they call her a *Light Frigat*.

FRIGATOON, is a *Venetian* Veſſel, commonly uſed in the *Adriatick*: She is built with a ſquare Stern, without any Fore-maſt; having only a Main-maſt, Miſſen-maſt, and Bow-ſprit.

FRIGID *Zones*: See *Zones*.

FRIGORIFICK *Particles*, are ſmall Particles of Matter actually and eſſentially Cold, which entring and penetrating others Bodies, do (according to the Opinion of *Gaſſendus* and others) produce in them that Quality which we call Cold: See *Cold*.

FRISE: See *Freez*. This the *French* call the *Gorgerin* or *Collier*.

FRIT, FRITT, } is the Matter or Ingredients whereof Glaſs is made, calcined or baked in a Furnace. A Salt drawn from the Aſhes of the Plant *Kali*, or from Fern mix'd with Sand or Flints, and baked together, make an opaque Maſs, call'd by the Glaſs-Men *Frit*.

FRODMORTEL, or rather *Freemortell*, in Law, is an Immunity or Freedom granted for Murder or Man-ſlaughter. *Cowel*.

FROENULUM, or *Frœnum Penis*, is a Membrane which ties the *Præputium* to the Glands of the *Penis*. L.

FRONT, in *Perſpective*, is the Orthographical Projection of an Object upon a parallel Plane.

FRONT, [in *Fortification*,] is what the *French* call *Tenaille de Place*, and the Face of a Place. It is that which is comprehended between the Points of any two neighbouring Baſtions, *viz.* the Courtine, the two Flanks which are raiſed upon the Courtine, and the two Faces of the Baſtions which look towards one another.

FRONT-LINE, in *Perſpective*. See *Line of the Front*.

FRONTAL, [in *Architecture*,] is a little Fronton or Pediment, ſometimes placed over a little Door or Window.

FRONTALE, or *Frontlet*, is an external Medicine, frequently applied to the Forehead for a Pain or Heat in the Head: It is made for the moſt part of Herbs, Flowers, Seeds, Meal moiſtned with Vinegar of Roſes. *Blanchard*.

FRONTALIS, is a Muſcle which ariſes thin, broad, and fleſhy from the upper Part of the *Os Frontis*, near the *Sutura Coronalis*, and deſcending by the poſterior and forepart of the *Temporalis*, meets with its Partner near their Inſertions to the Skin of the Eye-brows; theſe draw up and wrinkle the Skin of the Forehead. *L.*

FRONTATUM, is a Term uſed by Mr. *Ray*, and other Botaniſts, to expreſs that the Leaf of a Flower *(Petalum)* grows broader and broader, and at laſt perhaps is terminated by a right Line; and 'tis uſed in oppoſition to *Cuſpidatum*, which expreſſes that the Leaves of a Flower end in a Point. *L.*

Thus Marygolds, *Petala habent Frontata*,
But *Flos Solis*, *cuſpidata*.

FRONTIS *Os*, or *Coronale*, is a Bone of the *Cranium*, in form almoſt round; it joins the Bones of the *Sinciput* and Temples, by the Coronal Suture, and the Bones of the upper Jaw by the *Sutura Tranſverſalis*, and the *Os Sphænoides* by the *Sutura Sphænoidalis*. It forms the upper Part of the Orbit, (and it hath four *Apophyſes*, which are at the four Angles of the two Orbits. It has two Holes above the Orbits, through which paſs the Vein, Artery, and ſome Twigs of the firſt Branch of the fifth Pair of Nerves. It has alſo one in each Orbit, a little above the *Os Planum*, through which a Twig of the Ophthalmick Branch of the fifth Pair of Nerves paſſes to the Noſe, it is the Orbiter *Internus*. It has two *Sinus's* above the Eye-brows, between its two Tables; they are lined with a thin Membrane, in which there are ſeveral Blood-Veſſels and Glands, which ſeparate a Mucous Seroſity, which falls into the Noſtrils. The Inſide of this Bone has ſeveral Inequalities, made by the Veſſels of the *Dura Mater*. It has two large Dimples, made by the anterior Lobes of the Brain. Above the *Criſta Galli* it has a ſmall blind Hole, into which the End of the *Sinus Longitudinalis* is inſerted. From this Hole it has a pretty large Spine which runs up along its Middle; inſtead of this Spine there is ſometimes a *Sinus*, in which lies the *Sinus Longitudinalis*, which ought to be obſerved carefully by Surgeons in Wounds of this Place. This Bone is thicker than the *Sinciput* Bones, but thinner than the *Os Occipitis*: In Children it is always divided into its Middle by a true Suture. *L.*

FRONTISPIECE, [in *Architecture*,] the Portail or principal Face of a fine Building.

FRONTON, is a Part or Member in Architecture, which ſerves to compoſe an Ornament raiſed over Doors, Croſs-works, Nitches, &c. ſometimes making a Triangle, and ſometimes Part of a Circle. It is alſo called *Faſtigium* by *Vitruvius*, and *Pediſment* by the *French*.

FROZEN *Zones*: See *Zones*.

FRUCTIFEROUS, [*Fructifer*, L.] is that which produces Fruit; and is a Word uſed by my Lord *Bacon* and others, for ſuch Experiments in Natural Philoſophy, which are advantageous to the Experimenter in Point of Gain or Profit.

FRUGIVOROUS *Birds*, according to Mr. *Willoughby*, are the *Parrot-Kind*, which tho' they have a crooked Beak and Talons, and therefore do belong in general to Birds of Prey, being Rapacious and Carnivorous; yet becauſe they eat *Fruit* too, I ſuppoſe, he diſtinguiſhes them from the reſt by this Title. See *Birds*.

FRUIT, [in its *General Senſe*,] includes whatever the Earth produces for the Nouriſhment and Support of Men and other Animals; as Herbs, Grain, Pulſe, Hay, Corn, &c.

FRUIT, [in the Senſe of the *Civil Law*,] are diſtinguiſh'd into three kinds; as *Natural Fruit*, which the Earth produces ſpontaneouſly, and without any Culture, as that of Trees.

2. *Civil Fruits*, which are only Fruits in the Eye of the Law; as Rents, Salaries, Wages, &c.

3. *Fruits of Induſtry*, which tho' they are natural, do yet require ſome labour to cultivate them.

FRUITS, [in the *Canon Law*,] include every Thing whereof the Revenues of a Benefice conſiſt; as Glebe, Tithes, Rents, Offerings, &c.

FRUMENTA, and *frumentaceous Plants*, are by the Botaniſts reckon'd all ſuch as have their Culm (or Stalk) pointed, and their Leaves like Reeds; and which bear their Seed (which is fit to make Bread, or be ground into Flower) in *Ears*, like common Corn; for they reckon two Kinds of *Fruges*, *Frumenta* and *Legumina*: See *Gramineous* and *Culmiferous Herbs*. L.

FRUMGYLD, was the old *Saxon* Term for the firſt Payment made to the Kindred of a ſlain Perſon, in Recompence of his Murder.

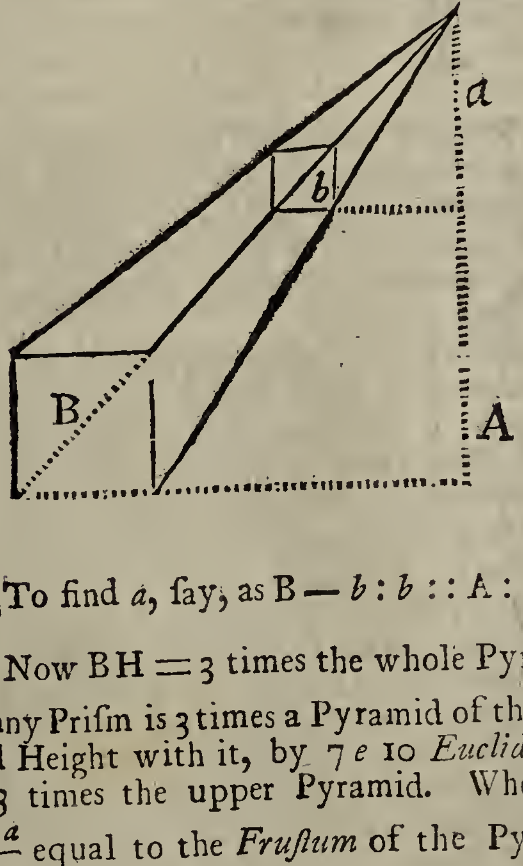
FRUSTUM, [in *Mathematicks*,] ſignifies a Piece cut off, or ſeparated from any Body; as the *Fruſtum* of a Pyramid or Cone, is a Part or Piece thereof cut off (uſually) by a Plane parallel to the Baſe. *L.*

All Round and Square Timber that is tapering may be conceiv'd as the *Fruſtum* of a Cone or a Pyramid. To find which, take the following Theorem, which in the main is Mr. *Oughtred*'s, who at *Pag.* 99. of his admirable *Clavis*, gives this and two others for the ſame Purpoſe.

Given

B, the Side of the greater Baſe,
b, the leſſer Baſe's Side,
A, the Height of the *Fruſtum*,
} Tho' below I ſuppoſe B and b to repreſent the Areas of the two Baſes.

Whole Height $a + A = H$.



Firſt, To find a, ſay, as $B - b : b :: A : \frac{b\,A}{B - b}$ or $\frac{b\,A}{X}$. Now $BH = 3$ times the whole Pyramid, becauſe any Priſm is 3 times a Pyramid of the ſame Baſe and Height with it, by 7 *e* 10 *Euclid*, and $b\,a = 3$ times the upper Pyramid. Wherefore $\frac{BH - b\,a}{3}$ equal to the *Fruſtum* of the Pyramid required: Which Theorem in Words is this:

> *Multiply the lower Baſe by the whole Height, and from the Product ſubtract the upper Baſe multiply'd by the Height of the Top-piece wanting; and then one third of the Remainder ſhall give the* Fruſtum.

And the ſame way you may proceed for the *Fruſtum* of a Cone; only 'twill be more difficult to find the Circular Baſes.

FUGA *Vacui*: It is a Notion of the *Peripateticks*, and ſome other ancient Philoſophers, that there is an *Abhorrence in Nature of a Vacuum*; and this in *Latin* they call *Fuga Vacui*, or Nature's endeavour to avoid a *Vacuum*. L.

FUGILE, an Impoſthume in the Ears. *Blanchard.*

FUGITIVES *Goods*, are the proper Goods of him that flieth upon Felony, which after the Flight lawfully found, do belong to the King or Lord of the Mannor.

FUGUE, [in *Muſick*,] is ſome Point conſiſting of 4, 5, 6, or any other Number of Notes begun by ſome one ſingle Part, and then ſeconded by a third, fourth, fifth and ſixth Part, (if the Compoſition conſiſts of ſo many) repeating the ſame or ſuch like Notes, ſo that the ſeveral Parts follow, or come in one after another in the ſame manner, the leading Parts ſtill flying before thoſe that follow.

FUGUE-DOUBLE, is when two or more different Points move together in a *Fugue*, and are alternately interchanged by ſeveral Parts.

FULIGINOUS *Vapours*, according to ſome, are thick, impure, and ſooty *Vapours*.

FULMINATING *Powder*: See *Aurum fulminans*, and *Pulvis fulminans*.

FULMINATION, the ſame with *Detonation*: Which ſee.

FUMIGATIO *Chymica*, is an Eroſion of Metal by Smoak or Vapour. *L.*

FUMIGATION, is making one Body receive the Smoak of another, in order to impregnate it with the more Volatile Parts of the Body burnt.

FUNCTION, (the ſame that Action) is, in reference to any Operation of the Organical Parts of an Animal Body, an effective Motion produced in the Part by the proper Aptitude, or Fitneſs of ſuch Part for the Uſes the Author of Nature deſigned it.

FUNDAMENTAL, [in *Muſick*,] the principal Note of a Song or Compoſition, to which all the reſt are in ſome Meaſure adapted, and by which they are ſway'd; call'd alſo, the *Key of the Song*.

FUNDUS *Plantæ*, the Botaniſts call that the Bottom of a Plant, where the Stalk and Root juſt meet and join. *L.*

FUND *of the Eye*, [in *Anatomy*,] that part of the Eye poſſeſs'd by the *Chorocoides* and *Retina*.

FUNDUS *Uteri*, [in *Anatomy*,] *i. e.* the fund or bottom of the Womb, is the Body or principal part of it, in contradiction to the *Cervix* or Neck, the *Oſculum* or Mouth, and the *Vagina* or Sheath.

FUNDUS *Veſicæ*, [in *Anatomy*,] *i. e.* the fund of the Bladder, is the Cavity of it in which the Urine is contained. It is placed in Men over the *Rectum*, and in Women over the *Matrix*.

FUNDUS *Cœli*, [in *Aſtrology*,] is the Point oppoſite to the Point of Culmination; or that Point of the Ecliptick, wherein it is interſected by the Meridian, beneath the Horizon.

FUNGUS, [in *Surgery*,] a fleſhy Tumour and Excreſcence, very ſpongeous, ſoft, and pale; ariſing on the Membranes, Tendons, and other nervous Parts, proceeding from Ulcers, Wounds, Contuſions and Strains.

FUNICULAR *Hypotheſis*, was advanced by *Franciſcus Linus*, againſt the Notion of the Spring and Weight of the Air; and he ſuppoſes, That the Suſpenſion of the Mercury in the Torricellian Experiment, is not cauſed by the Weight of the Atmoſphere preſſing on the Mercury in the Baſin, but by a kind of *Funiculus* of ſome very fine and thin Subſtance; which being exceedingly rarified by a forcible Diſtenſion, is continually contracting it ſelf up, or becoming more diſtended according to the different Temperament of the external Air; and by this Means occaſions the riſing and falling of the Quickſilver in the Barometer.

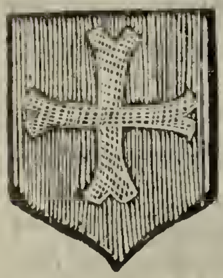
But 'tis ſtrange that this little Rope or String at the Top would be able to ſuſtain all the Mercury requiſite to form a Column of 30 Inches in length; and that as Part will run out of the Tube when there is more Mercury in it, ſo none at all ſhould run out after it is come to its due length: Since Mercury is a fluid Body, how comes the *Funiculus* to turn it into a ſolid one? And by its little Strings hold it ſo altogether, that none can run out?

FUNICULUS, *Inteſtinum*, *Laqueus*, or *Ductus Umbilicalis*, the Navel-ſtring, is a Membranous Channel or Conduit in the *Fœtus*, which reaches from the Navel to the *Placenta* in the Womb; it contains two Arteries, one Vein, and the Urinary Paſſage in the *Fœtus*, ſaith *Blanchard*. Indeed the Umbilical Veſſels between the Navel and the *Placenta* are wrapt up in a Production of the *Chorion* and the *Amnion*, which is generally about a foot and an half long, that the motion of the *Fœtus* may not pull the *Placenta* from the Womb: The uſe of this Navel-ſtring is to carry the Mother's Blood by the Veins to the *Fœtus*, for its Nouriſhment; and that which is unfit for this purpoſe, is carried back by the Arteries to the *Placenta*, while the *Fœtus* is ſtill ſupplied with more from the Vein; ſo that there is a continual circulation of Blood between the Mother and the *Fœtus*. *L.*

FURCA, [in our *antient Cuſtoms*,] the ſame as *Catafuccia*, or *Foſſa*, i. e. the Gallows and Pit; *viz.* a Right or Juriſdiction of puniſhing Felons; *i. e.* Men with Hanging, Women with Drowning.

FURCALE *Os*, the ſame with *Furcula*. L.

FURCELLA, the ſame with *Furcula*. L.



FURCHE; ſo the Heralds call the form of this kind of *Croſs* in a Coat of Arms.

FURCULA *Superior*, is the upper Bone of the *Sternum* or Breaſt-bone; others call it *Jugulum*. L. *Blanchard*.

FURFURATION, or *Furfures*, is when Dandriff falls from the Head in Combing; it comes for the moſt part from that Skin which is under the Hair; alſo from the Beard and Eye-brows. *L. Blanchard*.

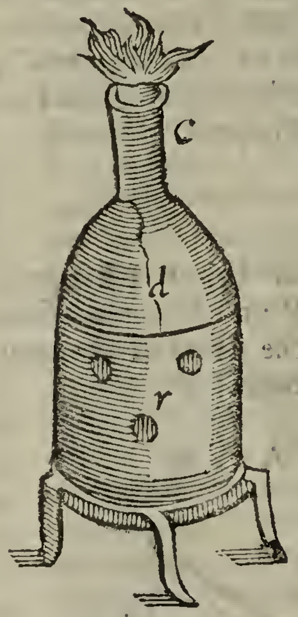
FURFURES, the Scales that fall from the Head, and ſometimes from the Skin of the other Parts of the Body, occaſion'd by the Separation of the *Cuticula* or Scarf-ſkin from the *Cutis*, or true Skin. *L. Blanchard*.

FURL, the Sea Word for wrapping up and binding any Sail cloſe to the Yard, which is done firſt by haling up the Braces, and then wrapping the Sail cloſe together, and ſo binding it faſt to the Yard with the Caſkets and furling Lines. This was formerly written *Farthel*, becauſe the Sail is thus made up in a bundle or *farthel*; but 'tis now every where corrupted into the Word *Furl*.

FURLING *Lines*, are ſmall Lines made faſt to the Top-ſails, Top-gallant-ſails, and to the Miſen-yard-Arms, to furl up thoſe Sails. Indeed the Miſſen hath but one furling Line, but all the reſt have two, one at each end.

FURNACE: The Chymiſts have ſeveral ſorts of Furnaces, as the *Reverberatory*; which ſee under that Word: A *Wind Furnace*, or *Furnace for Fuſions*, which is ſo called, becauſe the Wind comes forcibly to blow the Coals, in order to *melt* or *fuſe* the Matter in the *Crucible* or *Coppel*. This *Furnace* for *Fuſions*, is in form juſt like the Reverberatory, only leſs, and there is no need of laying the two Croſs Bars there mention'd. They frequently alſo uſe *Moveable Furnaces*, whoſe make is like that of the Reverberatory, and they are made of a Paſte conſiſting of three parts of Powders of broken Pots, and two parts of Clay well temper'd together with Water.

Lemery gives the following figure of a ſmall moveable *Furnace* for *Fuſions*.



c The Chimney.

d The Dome, conſiſting of two Pieces.

r Three Regiſters or Holes, to let in the Air to come to the Fire.

FURNACE *Almond*. In the ſmelting of Silver Oar, and clearing it from the Lead, they uſe a Furnace which they call an *Almond Furnace*; in which they melt the Slags or Refuſe of the Litharge, without pounding or ſtamping it, and with Charcoal only.

FURNACE *of Aſſay*, is uſed in the ſmelting Houſes of Silver Oar; and is to try the Value of the Silver, or what Proportion it bears to the Lead: Which they know by weighing the Pieces cut off from every Bar, and then melting them anew, and after the Lead is ſeparated, weighing the remaining Silver. See *Silver*.

FURNITURE *of Dials*. As on all Sorts of Dial Planes, *Strait Lines* may be deſcrib'd, which by the Shadow of a *Stile*, or a Line parallel to the Earth's Axis, will ſhew the true Hour of the Day: So by the Shadow of an *Apex*, *Nodus*, or one determinate Point in that Axis or Stile, on the Plane of the Dial, may many uſeful and curious Aſtronomical Concluſions be deſcrib'd or ſhewn: And all theſe taken together, are call'd the *Furniture of Dials*. Such as,

1. *The Parallels of the Sun's Diurnal Motion*; ſhewing every Day what Degree of the Ecliptick the Sun is in; or, if leſs Accuracy be thought enough, what Sign of the Zodiack.
2. *The Length of the Day and Night*; or, *The Proportion of the Sun's Diurnal to his Nocturnal Arch, throughout the Year.*
3. *The Time of the Year*; ſhewing, by the Shadow of the Axis, both the Month and Day.
4. *The Sun's Almacanters*, or, *Parallels of Altitude*; ſhewing the Sun's Altitude above the Horizon; and the Proportion of Shadows.
5. *The Azimuths*, or *Vertical Circles*; ſhewing what Azimuth or Point of the Compaſs the Sun is upon at all Times of the Day.
6. *The Babyloniſh*, *Italian*, *Jewiſh*, (or *unequal*) *Hours*; together with the Meridians or Horizons of

of any particular and remote Places; and many other Things, &c. I purpoſely omit to mention the Planetary Hours, the Circles of Poſition, &c. in order to Aſtrological Fooleries; becauſe, I hope, at this Time of Day, they are of no Eſteem with any Perſons of Mathematical Skill, or indeed of common Senſe and Underſtanding.

Now of theſe Circles of the Sphere, whoſe Projection conſtitutes this *furniture*; ſome are *Great*, as the Azimuths or Vertical Circles, the Meridians or Hour Circles, and the Circles of Longitude of the Sun or Stars; and theſe on all Sorts of Dial-Planes will be ſtrait Lines: And if the Planes on which ſuch great Circles are deſcrib'd, are parallel to ſuch great Circles in the Heavens as they are deſign'd to repreſent, then will thoſe ſtrait Lines be all parallel to one another.

But if the Dial-Plane be perpendicular to any of thoſe correſponding great Circles in the Heavens, then the ſtrait Lines ſo projected on the Plane, will meet in the Centre at *equal* Angles.

But if the Plane lie oblique to any of thoſe great Circles in the Heavens, the projected ſtrait Lines will ſtill meet in one Centre upon the Plane, but at *unequal* Angles.

All leſſer Circles of the Sphere, (ſuch as are, *the Parallels of the Sun's Declination or Courſe*, and all *Almacanters*, or *Parallels of Altitude)* being projected on a Plane, become *Conick Sections*, *i.e.* either *Ellipſes*, *Parabola's*, or *Hyperbola's*; except when theſe leſſer Circles are projected on ſuch Planes as do lie parallel to thoſe leſſer Circles in the Heavens; as Parallels of Declination, when they happen to be drawn on a Plane, lying parallel to the Equinoctial; for then they will be perfect Circles, which are Sections of a Cone parallel to its Baſe. So alſo, if the Almacanters, or Parallels of Altitude, be deſcrib'd on a Plane parallel to the Horizon, they will become perfect Circles.

It may be of Uſe to remark alſo, That all Dial-Planes in any Latitude, and however poſited in that Latitude, whether Direct, Declining, Inclining, or Reclining, or both Declining and Inclining, or Declining together, are, in ſome Part or other of the Earth, *Horizontal Planes*: And the *Height* of the *Stile* is equal to the *Latitude* of the Place wherein it is an *Horizontal Plane*; and the *Subſtile* of the Dial is the *Meridian* of that Place; and the *Difference of Longitude* of that Plane, ſhews how much to the *Eaſt* or *Weſt* the Place lies from *that* wherein it is an *Horizontal Plane*.

Whence it muſt follow, that if you draw, for any Declining-Reclining Plane, or any other Dial-Plane, a good Dial with Hours and Quarters; and much more if you draw it to Minutes, &c. and then, on the ſame Plane, with red Ink, &c. draw an Horizontal Dial for the Latitude of that Place, which is equal to the Stile's Height in the former Declining-Reclining, &c. Plane; and letting the Subſtile be the Hour-Line of 12 to it, draw all the other Hours, Quarters, &c. from thence; and then on that Horizontal Dial draw alſo the proper *Furniture*: When you have done this, I ſay, if you can expunge the Hour-Lines of the Horizontal Dial, the *Furniture* of that Horizontal Dial will be the true *Furniture* for the Declining-Reclining, &c. be it never ſo irregular, ſuppoſing it have but a Centre.

As to the Deſcription of this *Furniture* on all kinds of Dial-Planes, you will find large and full Directions in *Well's Art of Shadows*, *Hollwell's* and *Leybourn's Dialling*, &c. And the full Demonſtration of the whole Matter, *Chriſtopher Clavius* gives us in his *Gnomonicks*. See alſo *Gaſpar Schottus's Curſus Mathematicus*, Book 14. of *Horography*.

FURRING, [in *Architecture*,] is making good the Rafters-feet in the Corniſh: That is, when Rafters are cut with a Knee, theſe *Furrings*, or *Furrs*, are Pieces that go ſtraight along with the Rafter from the Top of the Knee to the Corniſh. Alſo when Rafters are rotten, or ſunk hollow in the Middle, there are Pieces cut thickeſt in the Middle, and tapering towards each End, which are nailed upon them to make them ſtrait; and ſuch Pieces are call'd *Furrs*, and the putting them on, *furring* the Rafters.

FURRING *of a Ship*, is laying on double Planks on her Sides; this is done after the Ship is built, and is by the Sailors called *Plank upon Plank*: But there is another way of *Furring* which is more properly ſo called; and that is, when a Ship's Planks are ripped, and new Timbers are put on the former Timbers, and on them other Planks; which is done ſometimes to make a Ship bear her Sails the better.

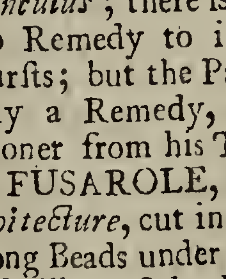
FURRS, [in *Heraldry*,] are uſed in the Doublings of the Mantles pertaining to a Coat of Arms, and ſometimes to the Coat it ſelf. They are uſually of two Colours; as *Ermins* and *Ermines*, which are black and white: *Erminois* and *Pean*, which are black and yellow: *Vairy*, which is white and blue: *Verry*, which is yellow and red, or the like Colours.

FURUNCULUS, a Boil, is an acute Swelling as big as a Pigeon's Egg, attended with an Inflammation and Pain, eſpecially when it begins to corrupt and putrifie; when it is open'd, and the Matter let out, part of the Fleſh underneath is turned into Corruption of a whitiſh and reddiſh Colour, which ſome call the Ventricle of the *Furunculus*; there is no danger in it, tho' you apply no Remedy to it; for it ripens of it ſelf, and burſts; but the Pain makes it more eligible to apply a Remedy, becauſe that frees the Patient ſooner from his Trouble. *L. Blanchard.*

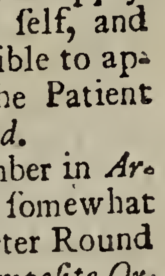
FUSAROLE, is a ſmall round Member in *Architecture*, cut in form of a Collar, with ſomewhat long Beads under the *Echinus*, or Quarter Round of Pillars of the *Dorick*, *Ionick*, and *Compoſite Orders*.

FUSE or *Fuſel* of a Bomb, or Granado-ſhell, is that which makes the whole Powder, or Compoſition in the Shell take fire, to do the deſigned Execution; 'tis uſually a Wooden Pipe or Tap filled with Wild-fire, or ſome ſuch Compoſition, and is deſign'd to burn ſo long, and no longer, as is the Time of the Motion of the Bomb from the Mouth of the Mortar to the Place where it is to fall; which Time Mr. *Anderſon* makes to be about 27 Seconds; ſo that the *Fuſe* muſt be contrived either from the Nature of the Wild-fire, or the length of the Pipe which contains it, to burn juſt that Time.

FUSIL, [in *Heraldry*,] is a Rhomboidal figure; more ſlender than a Lozenge. Thus,



And ſometimes thus;

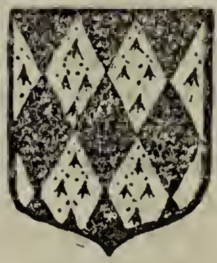


The latter of which ſeems to be the true figure, for the *Fuſil* was antiently a kind of Spindle uſed in Spinning.

The Word *Fuſil* alſo ſignifies a Fire-lock; whence comes our Word *Fuſileers*, *i. e.* Soldiers carrying only Fire-Arms, and without Pikes.

FUSILEERS, are (in an Army) the ſame with Muſqueteers, and are ſo called from the Word *Fuſil*, which ſignifies ſometimes a Muſket.

FUSILLY, in *Blazon*, is when the Field of an Eſcutcheon is divided throughout into *Fuſils*, as thus:



He beareth *Fuſil Sable* and *Ermin.*

The like is to be underſtood of *Lozengy*, or *Fretty*, reſpect being had to the figure.

FUSION, [in *Chymiſtry*,] is the ſame as *Melting*; ſo that their Furnace for melting of Metals, is called the Furnace for *Fuſions*. The Cauſe of *fuſion*, or the Reaſon of melting Metals, &c. is this, That by the force of the Heat or Fire, the Coheſion of the Parts is diſſolved, and the Metalline Particles being disjoined, and having a figure proper to ſlide over one another's Surfaces, are moved with a moſt rapid Motion, and ſo put on the form or appearance of a Fluid. *L.*

FUST, is a Term in *Architecture* for the Shaft of a Column, from the *Aſtragal* to the *Capital.*

FUSY, or *Fuzee*, is that Part of a Watch about which the Chain or String is wrapped, and is that which the Spring draweth, being in form commonly taper. In larger Works going with Weights it is Cylindrical, and is called the Barrel.

To find what Number of Turns the *Fuſy* will have, uſe this Proportion:

As the Beats of the Balance in one Turn of the Great-Wheel or *Fuſy*, (ſuppoſe 26928): Is to the Beats of the Balance in one Hour (20196):: So the continuance of the Watches going in Hours (ſuppoſe 16): To the Number of Turns of the *Fuſy* (12).

That is, 26928 : 20196 :: 16 : 12.

FUTTOCKS, are the Compaſſing Timbers in a Ship; which make her Breadth; thoſe below next the Keel are called her *Ground Futtocks*; the other the *Upper Futtocks*.

* * *

GAB GAI

G, [In *Muſick*,] is one of the Cliffs, and is the higheſt call'd the *Treble*.

GABELL, *Gabella*, *Gabellum*, the ſame with *Vectigal* in old Writers, hath the ſame Signification as *Gabelle* in *French*: And for the better underſtanding of ancient Records, Statues, Charters, &c. you ſhould know, that *Gabel*, or *Gavel*, *Gablum*, *Gabellum*, *Gabellettum*, *Galbellettum*, and *Gavillettum*, do all ſignify a Rent, Cuſtom, Duty, or Service, yielded or done to the King, or ſome other Lord: And Dr. *Cowell* ſeems to have judg'd right, that *Gablum* is to be diſtinguiſh'd from a Rent or Payment made, or a Contract or Bargain; and hath only Relation to ſuch a Payment or Service as was impoſed by the Power and Will of the Lord.

GABEL, according to ſome of our Ancient Records, Statutes, Charters, &c. ſignifies a Rent, Cuſtom, or Duty, yielded or done to the King, or any other Lord, not by Contract or Bargain, but impoſed by the Will of the Lord. Both the Word and Thing it ſelf is grown quite out of faſhion in *England*, where no Duty can be impoſed upon the Subject but by Act of Parliament; but in *France* it is ſtill practiſed, where it ſignifies an Exciſe upon Salt, and is a very heavy one.

GABEL-*End* of a Houſe, is the Upright Triangular End, from the Corniſh or Eaves, to the Top of its Roof.

GABIONS, a Term in *Fortification*, ſignifying Baſkets made of Oſier-Twigs, equally wide at the Top and Bottom, about four foot in Diameter, and from five to ſix high; which being filled with Earth, are ſometimes uſed as Merlons for the Batteries, and ſometimes as a Parapet for the Lines of Approach, when it is requiſite to carry on the Attacks through a ſtony or rocky Ground, and to advance them with extraordinary Vigour. They ſerve alſo to make Lodgments in ſome Poſts, and to ſecure other Places from the Shot of the Enemies, who nevertheleſs endeavour to ſet the Gabions on Fire with pitch'd Faggots, to render them uſeleſs.

GAGE, [in *Joinery*,] is an Inſtrument made to ſtrike a Line truly parallel to the ſtrait Side of any Board or Piece of Stuff. Its chief Uſe is for gaging of Tenons true to fit into Mortiſſes, and for gaging Stuff of an equal Thickneſs. It is made of an oval piece of Wood, fitted on upon a ſquare Stick, to ſlide up and down ſtiffly thereon, and with a Tooth in the End of a Staff, to ſcore or ſtrike a Line upon the Stuff at any Diſtance, according to the Diſtance of the Oval from it.

GAGE, when one Ship is to Windward of another, ſhe is ſaid to have the *Weather-gage* of her: The Seamen call alſo trying how much Water a Ship draws, *Gaging*, or rather *Gauging of her*; and it is thus done; They drive a Nail into a Pike near the End, and then put down this Pike by the Rudder till the Nail ketch hold under it, for then as many Feet as the Pike is under Water, is the *Ship's Gage*, or the Depth of Water ſhe draws.

GAGE, [in *Common Law*,] ſignifies a Pawn or Surety: See more in *Wage*.

GAGE-POINT: See *Gauge-Point*.

GAGER *Deliverance*: See *Wage*.

GAIN, [in *Architecture*,] is the Workmen's Term for the Bevelling Shoulder of the Joiſt or other Timber. 'Tis uſed alſo for the lapping off the End of the Joiſt, &c. upon a Trimmer or Girder; when the Thickneſs of the Shoulder is cut into the Trimmer alſo, and bevelling upwards that it may juſt receive the *Gain*; and ſo the Joiſt and Trimmer lie even and level with their Surface. This way of working is uſed in Floors and Hearths.

GAINAGIUM, or *Wainagium*, ſignifies all manner of Plough-Tackle, or Inſtruments uſed in Huſbandry, without any Reſpect to *Gain*, or *Profit*.

For as *Magna Charta* provides, That the Knight and Freeholder ſhall be amerced *Salvo Contenemento ſuo*, and the Merchant *Salvâ Mercandisâ ſuâ*; ſo the Villain Countrymen, or Plowman, was to be fined or amerced for his Offences, but ſtill *Salvo Guinagio ſuo, i. e. Saving all his Plow-Geers, and neceſſary Implements of Husbandry:* For he was not to be fined ſo as to be ruined and undone, by taking from him the neceſſary Means of Life.

GALACTOPHORI *Ductus*, [of γαλα γαλάκτος Milk, and φέρω, Gr. I carry,] Veſſels which ſerve to convey the Milk into the Breaſts of Women, &c. as the *Lacteal* and *Mammary* Veſſels; and alſo convey the Chyle, (as ſome modern Authors have fancied;) a ſtrait way from the Guts to the Glandules of the Breaſts; yet the Arteries are more properly ſo called, becauſe they carry the Chyle along with the Blood to the Breaſts, wherein the Milk is ſeparated and reſerved for the Uſe of the *Fœtus*. L.

GALACTOSIS, [γαλακτωσις, Gr.] the changing into, or the production of Milk; that Action whereby the Food or Chyle is converted into Milk.

GALAXY, or *Via Lactea*: See *Milky-Way*.

GALE, the Sea Word for the blowing of the Wind at Sea: When the Wind blows not ſo hard but that a Ship can carry her Top-ſails a Trip, (that is, hoiſed up to the higheſt) then they ſay it is a *Loom-Gale*; when it blows very ſtrong, they ſay it is a *ſtiff*, or *ſtrong*, or at leaſt, a *freſh Gale*; but when it blows ſo hard and violently that a Ship cannot bear any Sail, they ſay it blows a *Storm*. When two Ships are near one another at Sea, and there being but little Wind blowing, one of them finds more of it than the other, they ſay that the Ship *Gales* away from the other.

GALEA, is a Pain in the whole Head, ſo called from the Likeneſs of the Place, becauſe it takes in, or encompaſſes the whole Head like an Helmet; in *Latin Galea*. *Blanchard.*

GALEA is likewiſe uſed when the Head of the *Fœtus* is cloſed with Part of the Membrane called *Amnion*, as it comes into the World; they ſay then it hath a *Galea*. *Blanchard.*

GALEASS, is a large, low-built heavy Veſſel, uſing Sails and Oars: It hath three Maſts, and thoſe not to be lower'd, as they are in a Galley. They have three Tire of Guns in the Head, and uſually two Tire in the Stern. In two *Dutch* Prints that I have of a *Galeaſs*, there are 25 Oars on a Side; and I'm told, there is about 6 or 7 Men to an Oar.

GALENICK-*Medicine*, is that Phyſick which is built upon the Principles of *Galen*, and therefore they are *Galeniſts* who embrace the Foundations of that Art, which are fetched from *Galen* and his Principles; though 'tis now frequently oppoſed to the Chymical Method of Practice, which, they ſay, is much ſhorter. *Blanchard.*

GALEONS, were formerly the *French* Ships of War; but now the Word is only uſed amongſt the *Spaniards* and *Italians*. And the *Spaniards* do now call only thoſe Ships *Galeons*, which are ſent annually to *La Vera Cruz*, or other Places, in the *Weſt-Indies*, to fetch home Bullion.

GALL: See *Bile*.

GALL. Dr. *Keil* ſhews, *An. Secret. p.* 36. That the Gall or Bile, being to be mixed with the Chyle, as it comes out of the Stomach into the *Duodenum*, could be no where ſo conveniently ſecerned from the Blood, as where the Liver is placed, had alſo all the Branches of the Celiack Arteries, carry'd all the Blood to the Liver, from which the Gall was to be ſeparated: It is evident, conſidering the Nearneſs of the Liver to the Heart, and the Inteſtine Motion of the Blood, that ſo viſcid a Secretion, as the Gall is, could never have been ſeparated by any Gland in that Place. In this Caſe therefore, Nature is forced to alter her conſtant Method of ſending the Blood to all Parts of the Body by the Arteries; and here ſhe forms a Vein, (which is no Branch of the *Cava*, as all other Veins are) and by it ſhe ſends the Blood from the Branches of the meſenterick and celiack Arteries, (after having paſſed through all the Inteſtines, Stomach, Spleen, Caul, and Pancreas) to the Liver. By which extraordinary Contrivance, the Blood is brought a great way about, before it arrive at the Liver; and its celerity is extremely diminiſh'd: So that all the Corpuſcles which are to form the Gall, may have ſufficient Time to attract one another, and to unite, before they come to their ſecerning Veſſel. And thus the Uſe of the *Vena Porta* is found out.

And moreover he computes, that ſince a Branch of the meſenterick Artery is to its correſponding Branch of the *Porta*, as 9 to 25, therefore the Blood in the Branches of the *Porta* moves above 177 times ſlower than it does in the Trunk of the meſenterick Artery; and this only on the Account of the Increaſe of the Diameters of the Veſſels.

Thus Nature provides for the forming of the Gall, in that Blood which paſſes through the meſenterick Artery. Next he enquires what Care is taken about that which is convey'd by the celiack Artery to the Liver. For it ſeems it was neceſſary to ſend a larger Quantity of Blood thither, than could be diſpoſed of through the Inteſtines. Part of the Blood of the celiack Artery is ſpread upon the Stomach and Caul, and its Velocity diminiſhed, as we have ſeen in the Inteſtines: But ſtill all the Blood which thoſe Parts could receive, was not ſufficient for the Liver; and there was no room for the diviſion and expiating of the Veſſels through ſuch a large Space as the Meſentery, and the long Tract of the Guts. And therefore here Nature hath a new Contrivance to abate the Velocity of the Blood, (to which the inteſtine Motion is always proportional); which is, by empting the Blood entirely out of the Veſſels, into a large ſpongy Bowel, the *Spleen*; which ſeems to be a Ciſtern produced for that very Intent and Purpoſe. And the Circumference of the celiack Artery being half an Inch, or .5 its Square is .25: And therefore the Square of the Splenick, which is a Branch of it, cannot be above .18. Now the Dimenſions of the Spleen are ſix Inches long, 3 or 4 in Breadth, and 2 in Thickneſs. He makes therefore this eaſy Suppoſition, That it is a Cylinder of 2 Inches Diameter. Wherefore the Square of its Circumference being 36, the Blood muſt move above 200 Times ſlower in it, than in the Beginning of the ſplenick Artery; and is longer before it gets to the Liver, than that which paſſes through all the Inteſtines.

From all this Art and Contrivance, it is an evident Demonſtration, that the Intent of Nature was to diminiſh the Velocity of the Blood; and that ſuch a ſlow Motion is abſolutely neceſſary for the ſecerning of the Bile in the Liver.

The Particles which compoſe the Gall, he ſhews, bear a very ſmall Proportion to the reſt of the Blood; as is evident from that great Quantity of Blood which is carry'd to the Liver, and the ſmall Quantity of Bile which is ſeparated from it. In a large Dog, whoſe *Ductus Choledocus* was near as big as a Man's, I could never gather above two Drams in an Hour. Now there is thrown into the *Aorta* every Hour about 4000 Ounces of Blood; and it appears by the Proportions of the Arteries, that the meſenterick and celiack are to the reſt, as 1 to 8. And therefore 500 Ounces of Blood are carry'd every Hour to the Liver. And ſince only two Drams of Gall are ſeparated from it, the Blood muſt be to the Bile, at leaſt as 2000 is to 1.

'Tis by reaſon of this ſmall proportion of the Bile to the Blood, that it was ſo neceſſary to allow ſo much Time for the attraction of the Particles which form the Bile.

From this Contrivance alſo of the *Aorta*, the Bile receives another advantage, not leſs conſiderable than the diminution of the velocity of the Blood; and that is, the Blood paſſing thro' ſo many different Parts before it comes to the Liver, parts with the greateſt Share of its *Lympha*. By which means, the Particles compoſing the Bile approaching nearer towards one another, are by their mutual attraction ſooner united.

And the Conſideration of theſe two Contrivances does highly (he thinks) confirm the Truth of his Theory of *Animal Secretion*. For the Diminution of the Velocity of the Blood, and the Subtraction of the *Lympha*, can agree in no other End, than the uniting the Particles of the Bile.

GALL-*Bladder*, the ſame with *Folliculus Fellis*.

GALLEHALPENS, were formerly a *Genoa* Coin, brought into *England* by the Merchants of that City; who trading hither in *Galleys*, lived commonly in a Lane near *Tower-ſtreet*, call'd from them *Galley-Lane*; and they landed their Goods at a Place in *Thames-ſtreet*, call'd *Galley-Key*; and they traded with their own ſmall Silver Coin, which our People call'd *Gallehalpence*. But theſe, together with two kinds of Coin, call'd *Suskins*, and *Dotkins*, were forbidden by the Statute of 3 *H.* V. 1. See *Stow's Survey of London*, p. 137.

GALLERY *of a Mine*, is any Branch of it carried on towards any Place. For the Beſiegers, and the Beſieged, do carry each of them Galleries or Branches under Ground, in ſearch of one another's Mines, which often meet and deſtroy one another.

GALLERY, in a Ship, is that beautiful Frame which is made upon the Stern without-board, into which there is a Paſſage out of the Captain's Cabbin, which is called the great Cabbin; and theſe Galleries are indeed rather for ſtately Shew, and the Captain's Pleaſure, than any other Benefit; for in Ships of War all open Galleries of this kind are to be avoided, in regard of the Facility of an Enemy's Entrance, and boarding of the Ship that way.

GALLERY, [in *Fortification*,] is a covered Walk, the Sides whereof are Muſket-proof, conſiſting of a double Row of Planks lined with Plates of Iron; the Top being ſometimes covered with Earth or Turf, to hinder the Effect of the artificial Fire of the Beſieged. Theſe Galleries are frequently made uſe of in the Moat already filled with Faggots and Bavins, to the end that the Miner may approach ſafe to the Face of the Baſtion, when the Artillery of the oppoſite Flank is diſmounted.

GALLEY, is a low-built Ship, uſing both Sails and Oars. Uſually they have only a Main-maſt and a Fore-maſt, which may be ſtruck or lowered at pleaſure. 'Tis ſaid, their Length is uſually about 130 Feet, and their middle Breadth about 18, and the Length of the Oar is about 36 Feet, and about 4 or 5 Men to an Oar. They are of Service only in the Mediterranean, and ſuch ſtill quiet Seas. Theſe were like the *Roman Liburnicæ*. See my *Introduction to the Bibliotheca Navigantium & Itinerantium*, about the *Antient Shipping*.

GALLIOT, is a ſmall Galley, or a ſort of *Brigantine*, built very ſlight, and deſign'd for Chaſe. She hath but one Maſt, and can both ſail and row. She uſually carries two or three Pedrero's, and hath 16 or 20 Oars. Some call the Bomb-Ketches *Galliots*.

GALREDA, a thick viſcous Juice that is extracted by boiling from the griſtly Parts of Animals, and is uſually called a *Gelly*.

GAMM, GAMMUT, GAMUT, [in *Muſick*,] a Scale whereon Learners are inſtructed to ſound the muſical Notes, *Ut*, *Re*, *Mi*, *Fa*, *Sol*, *La*, in their ſeveral Orders and Diſpoſitions. The Invention of this Scale is aſcrib'd to *Guido Aretin*, a Monk of *Aretium* in *Tuſcany*, tho' it is not ſo properly an Invention as an Improvement of the *Diagram* or Scale of the Antients. For he finding that the *Greek* Diagram was of too ſmall Extent, added five more Chords or Notes to it, four above the *Nete* or acuteſt, and one below the *Proſlambenomenos* or graveſt Note of the Antients. This Gammut is alſo call'd the *harmonical Hand*, becauſe *Guido* firſt made uſe of the figure of a Hand to arrange the Notes on.

GAMM, GAMMA, GAMMUT, [in *Muſick*,] the firſt or graveſt Note in the modern Scale.

GAMING. For the Laws of Chance in Games: See *Play*.

GANG. To Man the Boat, in the Sea Phraſe, is to put a Gang of Men (which is a Company) into her: They are commonly called the Coxſwain's Gang who hath the Charge of her.

GANGWAY, ſignifies all the ſeveral Entrances, Ways, or Paſſages from one Part of the Ship to the other; and whatſoever is put in any one of theſe Paſſages, are ſaid to be laid or put in the *Gangway*.

GANGLION, [γάγγλιον, Gr. is an Humour in the tendinous and nervous Parts, proceeding from a Fall, Stroke, or otherwiſe: It reſiſts if ſtirred; if preſſed upon the Side is not diverted, nor can be turned round. *Blanchard*.

GANGRENE, [γαγγραῖνα, Gr.] is a cadaverous Corruption of a Part, attended with a beginning of Stink, Blackneſs, and Mortification. *Blanchard*.

GANTLET, [in *Surgery*,] a ſort of Bandage for the Hand.

GARB, the Term in *Heraldry* for a Wheat-Sheaf.

GARBLER *of Spices*, is an Officer of great Antiquity in the City of *London*, who may enter into any Shop, Warehouſe, *&c.* to view and ſearch Drugs, Spices, *&c.* and to *garble* the ſame, that is, to make them clean from any *Garbles* or Duſt. See 21 *Jac.* I. *c.* 19.

GARBOARD-*Plank*, the firſt Plank of a Ship faſtened on her Keel; as

GARBOARD-*Strake*, is the firſt Seam in a Ship next the Keel.

GARD *Du-Cord*, or *Gard-du-Gut*: See *Gardecaut*.

GARDECAUT, or *Gard-du-cord*, is that which ſtops the *Fuſee* of a Watch when wound up, and for that end is driven up by the String; ſome call it *Guard-Cock*, others *Gard-du-Gut*.

GARDEYNE *Del Egliſe*, or *Church-Wardens*, are Officers choſen in every Pariſh to have the Care and Cuſtody of the Church Goods; and they may have an Action for the Goods of the Church, and divers other things they may do for the Benefit of the Church: They are to join with the Overſeers for the making of Rates, and other Proviſions for the Poor of the Pariſh.

GARDIAN, or *Guardian*, ſignifies generally him that hath the Cuſtody or Charge of any Perſon or Thing; but moſt commonly him that hath the Education or Protection of ſuch People as are not of ſufficient Diſcretion to guide themſelves and their Affairs, being indeed as largely extended as *Tutor* and *Curator* among the *Civilians*; for whereas *Tutor* is he that hath the Government of a Youth until he come to fourteen Years of Age; and *Curator*, he that hath the impoſition and ordering his Eſtate afterwards, until he attain to the Age of five and twenty Years; or that hath the Charge of a frantick Perſon during his Lunacy; both theſe with us are called *Guardians*.

A *Tutor* is either *Teſtamentarius*, or *à Prætore datus ex Lege Atilia*; or laſtly, *Legitimus*: So we have three ſorts of *Guardians* in *England*, one ordained by the Father in his laſt Will, another appointed by the Judge, the third caſt upon the Minor by the Law and Cuſtom of the Land.

As to the firſt of theſe, a Man having Goods or Chattels, may appoint a *Guardian* to the Body or Perſon of his Child, by his laſt Will and Teſtament, until he come to the Age of fourteen Years, and to the diſpoſing and ordering of his Eſtate ſo long as he thinks meet, which is commonly to one and twenty Years of Age. The ſame he may do of Lands not holden *in Capite*, or by Knight's-Service; but the ancient Law in this Caſe is very much altered, and in all Caſes gives the Father Power to appoint a *Guardian* for his Child; but if the Father order no *Guardian* for his Child, the Ordinary may appoint one to manage his Goods and Chattels till the Age of fourteen Years; at which time he may chuſe him another *Guardian*, as by the Civil Law he may his *Curator*; for this Rule holds, that is, *Invito Curatur non datur*. And for his Lands, the next a-kin on that Side, by which the Land cometh not, ſhall be *Guardian*, who was formerly called *Guardian in Soccage*.

GARDIAN, or *Guardian of the Spiritualities*, is he to whom the *Spiritual Juriſdiction* of any Dioceſe is committed during the Vacancy of the See. And the *Guardian* of the *Spiritualities* may either be *Guardian* in Law, or *Jure Magiſtratus*, as the Archbiſhop of any Dioceſe within his Province; or *Guardians* by Delegation, as he to whom the Archbiſhop or Vicar-General doth for the time depute.

GARDIAN, or rather *Warden of the Cinque Ports*, is a principal Magiſtrate that hath the Juriſdiction of thoſe Havens in the South-Eaſt part of *England*, which are commonly called, *The Cinque Ports*; that is, the five *Ports* or *Havens*; who there hath all that Juriſdiction that the Lord High Admiral of *England* hath in Places not exempt.

GARGAREON, [γαργαρεών, *Gr.*] the ſame with the *Epiglottis*, or Cover of the Wind-pipe. Which ſee.

GARGARISM, [γαργαρισμὸς, *Gr.*] is a Liquid Medicine which is uſed to cleanſe the Mouth and the adjacent Parts, by gargling or moving it up and down in the Throat without ſwallowing; and it is either a Decoction, wherein convenient Syrups are diſſolved, or diſtilled Waters mix'd with Syrups, and ſometimes with mineral Spirits. *Blanchard*.

GARLAND, in a *Ship*, is that Collar of Rope which is wound about the Head of the Main-maſt, to keep the Shrouds from galling.

GARNET, is a Tackle in a Ship, having a Pendant coming from the Head of the Main-maſt, with a Block ſtrongly ſeized to the Main-ſtay juſt over the Hatch-way; in which Block is reeved the Runner, which hath an Hook at one End, in which is hitched the Slings; and at the other End is a double Block, in which the fall of the Runner is reeved, that ſo by it any Goods or Caſks that are not over-heavy, may be haled and hoiſed into, or out of the Ship; when this *Garnet* is not uſed, it's faſtened along by the Stay at the bottom of it.

GARNISHEE, is taken for the Party in whoſe Hands Money is attached within the Liberties of the City of *London*, ſo uſed in the Sheriff of *London*'s Court, becauſe he has had *Garniſhment* or Warning, not to pay the Money, but to appear and anſwer to the Plaintiff's Creditor's Suit.

GARNISHMENT, [in *Law*,] is a Warning given to one for his appearance, for the better furniſhing of the Cauſe and Court; as if one is ſued for the Detinue of certain Evidences and Charters, and ſaith, That the Evidences were delivered to him, not only by the Plaintiff, but another alſo; therefore prayeth that that other may be warned to plead with the Plaintiff, Whether the ſaid Conditions be performed or no? And in this Petition he is ſaid to pray *Garniſhment*. *New Book of Entries*, Fol. 211. Col. 3.

GARRISON, is a certain number of Officers and Soldiers that defend a Place.

GARSUMME, (*Gerſuma, a Spelm. Gloſſ.*) a Fine or Amerciament often mentioned in Doomſday Book.

GARTER, a Term in Heraldry, ſignifying the Moiety or half of a *Bend*: See *Bend*.

GARTER. The moſt Noble Order of the Garter, is an Order of Knighthood firſt inſtituted by our famous King *Edward* III. 1350. and inferior to none in the World; conſiſting of 26 Nobles, or Perſons of even yet higher Degree; *i. e.* Sovereign Princes, Kings, and Emperors; whereof the King or Queen of *England* is the Sovereign; and the reſt are ſtiled, The Companions of the Order. See *Cambden*, *Aſhmole*, &c.

Garter, is alſo the Title of the Principal King at Arms among our *Engliſh* Heralds. The Office was created by *Hen.* V. See *Stow*, *p.* 581. and *Stat.* 14. *Car.* II. *c.* 33.

GAS, a Word uſed by *Van Helmont*, and ſeems deſigned to ſignify in general a Spirit not capable of being coagulated: But he uſes it looſely in many Senſes; as he calls the vital Principle in Man, *Gas Vitale*; that ſulphureous or arſenical, or any other way noxious Damp which is found in ſome Mines, he calls *Gas Pingue Sulphureum*: Nay, ſometimes he calls the Air its *Gas Ventoſum*, as he doth Water *Gas Salium*; and in ſhort, ſpeaks very unintelligibly and inconſiſtently about it, as the Chymiſt's manner is in other Things.

GASTEROCNEMIUM, [γαστροκνήμιον of γαστὴρ the Belly, and κνήμη, Gr. the Shin-bone,] is the Calf of the Leg, whence its Muſcles are called *Gaſterocnemii*, from their ſwelling like a Belly: Therefore two of theſe Muſcles are called *Gaſterocnemii*.

GASTEROCNEMIUS *Externus*, alſo *Gemellus*, is a Muſcle of the *Tarſus*, ſo called, becauſe (with the *Soleus* or *Internus* of that Name) it compoſes the Calf of the Leg: It is alſo called *Gemellus*, from its being as it were double. It has two diſtinct fleſhy Originations, from the ſuperior and hindmoſt Parts of each Tubercle of the lower Appendage of the Thigh Bone, which in their Deſcent are each dilated into two large fleſhy Bellies, the innermoſt of which is thickeſt and largeſt, having each a differing Series of fleſhy Fibres, and join to each other near where they make a broad ſtrong Tendon, which narrowing it ſelf, joins with the great Tendon of the *Gaſterocnemius Internus*, four Fingers breadth above its Inſertion to the *Os Calcis*. When this Muſcle acts, the Foot is ſaid to be extended or pulled backwards, which Motion of it is very neceſſary in Walking, Running, Leaping, and ſtanding on Tiptoe, *&c.* Hence it is, thoſe that walk much, that carry heavy Burthens, Chairs, *&c.* and who wear low-heel'd Shoes, have theſe Muſcles larger than others.

GASTEROCNEMIUS *Internus*, is a Muſcle of the Foot, which is placed under the *Gaſterocnemius Externus* and *Plantaris*. It is alſo called the *Soleus* from its Figure, reſembling a Sole-Fiſh. Its externally fleſhy Part is covered with a tranſparent tendinous Expanſion, which makes it appear of a livid Colour. Its Beginning is partly tendinous, but chiefly fleſhy from the hindermoſt Part of the upper Appendix of the *Fibula*, and back-part of the *Tibia*, that is below the Inſertion of the *Subpopliteus*, and increaſing to a large fleſhy Belly compoſed of various Orders of fleſhy Fibres, ſome of them underneath aptly expreſſing the Figure of the Top of a Feather, whoſe *Stamina* here being tendinous, join with the great Tendon, which is about a Finger's breadth in Length, and inſerted to the ſuperior and hindmoſt Part of the *Os Calcis*. The Foot, together with the Toes, being as it were a Leaver to the whole Body, ought therefore to be attended with Muſcles of great Strength to extend it; wherefore we find theſe Muſcles ſo much to exceed the *Antagoniſt*, the *Tibia Antica*, as well in the advantageous Conſtruction of their differing Series of fleſhy Fibres, as their Magnitude and Inſertion at the Extremity of the *Os Calcis*, whereby they are not only rendred ſerviceable in Walking, Running, Leaping, *&c.* but do alſo ſupport the *Tibia* in Standing, leſt the ſuperincumbent Preſſure of the Weight of the Body ſhould make them incline forwards at their Articulations with the *Talus*.

GASTRIC, [γαϛρικος of γαϛὴρ, Gr. the Stomach or Belly,] a Term applied by *Anatomiſts* to divers Veins, on account of their proceeding from the Stomach, or that Ventricle which is called as above.

GASTROEPIPLOICA, [of γαϛήρ the Belly, and ἐπίπλοον, Gr. the Caul,] is the Vein and Artery which goes to the Ventricle and Caul.

GASTRORRHAPHIA, [γαϛροῤῥαφία of γαϛήρ and ῥαφὴ, Gr. a Suture,] is a Connexion of a Suture in the Wounds of the Abdomen.

GASTROTOMY, [γαϛροτομία of γαϛὴρ and τομὴ a cutting off, and τεμνω, Gr. to cut,] the cutting of the Abdomen: See *Cæſarean Section.*

GATE *of the Sea*, or a *Sea-Gate*, is when two Ships lie aboard one another in a Wave or Billow, and by that Means ſometimes become Rib-broken.

GAVEL, [in *Law*,] ſignifies Tribute, Toll, Cuſtom, yearly Rent, Payment, or Revenue, of which there are ſeveral kinds, as *Gavel-Corn*, *Gavel-Malt*, *Out-Gavel*, *Gavel-Fodder*, &c.

GAVEL-*Bread*, Corn-Rent, or Proviſion of Bread, referred from the Tenant to be paid in Kind.

GAVELCESTER, *Sextarius Vectigalis*, was a certain Meaſure of Ale, to be paid by way of Rent: It appears to be the ſame with *Tokeſter*, which hath ſometimes been corruptly written *Colceſter*; as perhaps in *Selden's Diſertation*, annexed to *Fleta*, *c.* 8.

GAVELET, is a ſpecial and antient kind of *Ceſſavit* uſed in *Kent*, where the Cuſtom of *Gavelkind* continueth, whereby the Tenant ſhall forfeit his Lands and Tenements to the Lord of whom he holdeth, if he withdraw from him his due Rents and Services. Mr. *S.* in his *Hiſtory of Gavel-kind* ſays, That this *Gavelet* was not a Rent or Service, but ſignified a Rent or Service withheld, denied, or detained, cauſing the Forfeiture of the Tenement to the Lord; with which the Lord *Coke* agrees, where he ſays, That *Gaveletum* is as much as to ſay, to ceaſe, or to let to pay the Rent. And it ſeems this Writ lay in *London* as well as *Kent*.

GAVEL-*Kind*, ſignifies, [in *Law*,] a Cuſtom, whereby the Land of the Father is equally divided at his Death among all his Sons, or the Land of the Brother at his Death equally divided among all his Brethren, if he have no Iſſue of his own. This Cuſtom is ſtill in force in divers Places of *England*, eſpecially in *Kent*, *Urchenfield* in *Herefordſhire*, and elſewhere, though with ſome Difference: and all *Gavel-kind* Lands in *Wales* are made deſcendable to the Heirs, according to the Courſe of the common Law. In *Gavel-kind*, tho' the Father be hanged, the Son ſhall inherit; for their Cuſtom is,

The Father to the Bough, the Son to the Plough.

GAVELLERTH, *Gavelhert*, the Duty or Work of plowing ſo much Earth or Ground, done by the cuſtomary Tenant for his Lord: As,

GAVEL-*Mede*, was the Duty of mowing Graſs, or cutting Meadow Land, required by the Lord from his cuſtomary Tenant. So,

GAVEL-*Rep*, or *Bedreap*, was the Duty of *Reaping* at the Bid or Command of the Lord.

GAVELLING-*Men*, Tenants which paid a reſerved Rent, beſides ſome cuſtomary Duties to be done by them.

GAUGE-*Point* of a ſolid Meaſure, is the Diameter of a Circle, whoſe *Area* is equal to the ſolid Content of the ſame Meaſure. Thus the Solidity of a Wine Gallon being 231 Cubick Inches, (according to *Wincheſter* Meaſure;) if you conceive a Circle to contain ſo many Inches, the Diameter of it will be 17.15; and that will be the Gauge-Point of Wine-Meaſure. And an Ale-Gallon containing 288 Cubick Inches; by the ſame Rule, the Gauge-Point of Ale-Meaſure will be found to be 19.15. *Vide* Wingate's *Rule of Proportion*, Chap. 10.

And after the ſame manner may the Gauge-Point of any foreign Meaſure be diſcover'd.

And from hence may be deduced, by way of Conſequence, that when the Diameter of a Cylinder in Inches is equal to the Gauge-Point of any Meaſure, (given likewiſe in Inches,) every Inch, in length thereof, will contain an Integer of the ſame Meaſure, *V. gr.* In a Cylinder whoſe Diameter is 17.15 Inches, every Inch in height contains one entire Gallon in Wine Meaſure; and in another, whoſe Diameter is 19.15, every Inch in length contains one Ale Gallon.

GAUGER, is an Officer of the King's Exciſe, whoſe Buſineſs it is to examine all Caſks of Beer, Wine, Oil, Honey, Butter, *&c.* and to give them a Mark of Allowance, (which is a Circle burnt with an Iron) before they be ſold in any Place of this Office. See 27 *E.* III. *c.* 8. 4 *R.* II. *c.* 1. 18 *H.* VI. 17. 23 *H.* VI. 10. 1 *R.* III. 13. 28 *H.* VIII. 14. and laſt of all, 12 *Car.* II. *c.* 4.

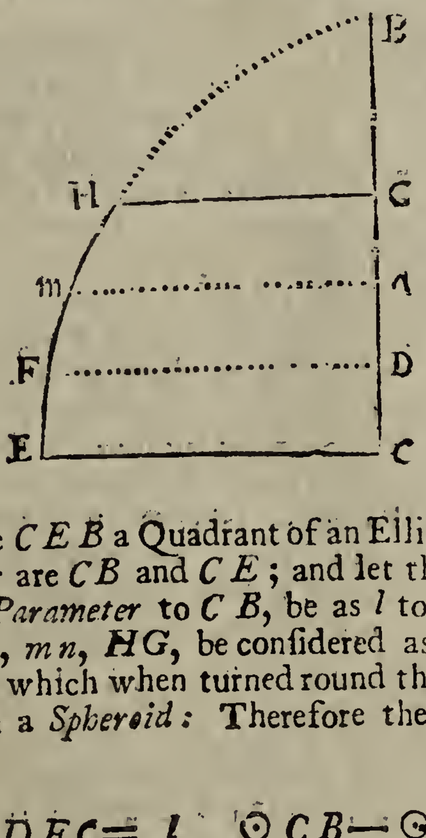
GAUGING, is the finding the Capacities or Contents of all ſorts of Veſſels which hold *Liquids*, *Powders*, *Meals*, *Corn*, &c.

If theſe are of a ſquare form like hollow Cubes or Parallelopipids, *&c.* ſuch as many ſorts of *Backs*, *Coolers*, *Fats*, &c. their Content is eaſily found, by multiplying the Area of the Baſe by the perpendicular altitude, as you find the Solidity of Parallelopipids and Priſms.

If they are of a cylindrical Figure, as Buſhels, Gallons, *&c.* you muſt, as near as you can, find the *Area* of the circular Baſe, and multiply that by the perpendicular *Altitude* as before.

If they are *Caſks*, of the uſual Form of our Hogſheads, Barrels, *&c.* Mr. *Oughtred* conſiders them as Segments of a *Spheroid*, cut off by two Planes perpendicular to the *Axis*.

And then Mr. *Caſwell* thus eaſily deduces his Theorem for meaſuring *Wine* and *Ale Caſks*.



Suppoſe *CEB* a Quadrant of an Ellipſis, whoſe *Semi-Axes* are *CB* and *CE*; and let the *Ratio* of the *Semi-Parameter* to *CB*, be as l to t; and let *EC*, *ED*, *mn*, *HG*, be conſidered as the *Radii* of Circles, which when turned round the *Axis*, *BC* ſhall form a *Spheroid:* Therefore the elemental Circle

$$\begin{array}{r} DF \\ \odot nM \\ \odot GH \end{array}\left\{\begin{array}{l} = l \quad \odot CB - \odot CD \\ = -\times \odot CB - Cn \\ = t \quad \odot CB - CG \end{array}\right\}$$

Wherefore the Fruſtum of the Spheroid is $=$

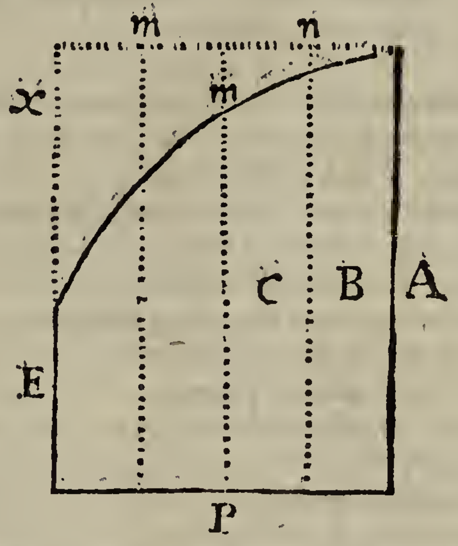
$$\frac{l}{t} p \times CB - \frac{1}{2} \odot CG: = \frac{1}{3} p \times \frac{l}{t} \odot CB - \frac{l}{t} \odot CG =$$

$$\boxed{\frac{1}{3} p \times 2 \odot CE + \odot HG}$$

Which laſt is Mr. *Oughtred*'s Theorem; in Words thus:

> *Add twice the Area of the Circle at the Bung, to the Area of the Circle of the Head; and then multiply that Sum by one Third of the Length of the Caſk, (which* p *ſtands for here, as being a Perpendicular to the Planes of theſe Circles) the Product is the Content of the Veſſel in Cubick Inches.*

But perhaps, ſays Mr. *Caſwell*, moſt of our Caſks had better be conſidered as *Fruſta* of a *Parabolick Spindle*; and then the ground of their Menſuration he thus deduces.



Suppoſe A the *Axis* of a *Parabola*, and P an Ordinate to that *Axis*, divided into innumerable Parts by B, C, &c. drawn parallel to the *Axis*, whoſe Differences from A, ſuppoſe n, m, *&c.*

$$\text{That is, } \left\{\begin{array}{l} B = A - n \\ C = A - m \\ E = A - x \end{array}\right.$$

$$\text{Therefore, } \left\{\begin{array}{l} B^2 = A^2 - 2An + nn \\ C^2 = A^2 - 2Am + mm \\ E^2 = A^2 - 2Ax + xx \end{array}\right.$$

But A^2, A^2, *&c.* is a Series of *Equals*, therefore $= p A^2$; and $2An$, $2Am$, *&c.* (by the Nature of the Parabola) is a Series of *Secundans*, therefore $= p \times \frac{2}{3} A x$. And nn, mm, xx, is a Series of *Quartans*, therefore $= \frac{1}{5} p x x$.

Therefore the Fruſtum of a *Pyramidoid*, made of A^2, B^2, C^2, *&c.* is $= P \times A^2 - \frac{2}{3} A x + \frac{1}{5} x x = \frac{1}{3} P x : \frac{1}{6} x x + 2A^2 + (A^2 - 2Ax =) E^2 - x x = \frac{1}{3} P x : 2A^2 + E^2 - \frac{2}{5} x x$.

Therefor if a Segment of a *Parabola*, cut off by a Line parallel to the *Axis*, be turn'd about its ordinately *Applicate P*; the Fruſtum of the acute *Parabolick Conoid*, ſo generated, or as ſome call it, a *Parabolick Spindle*, is $= \frac{1}{3} P \times : 2 \odot A + \odot E - \frac{2}{5} \odot x$.

So that the Fruſtum of a *Parabolick Spindle*, is leſs than the Fruſtum of the *Spheroid* of the ſame Baſe and Height by $\frac{2}{3} \odot x \times \frac{1}{3} P$; and for the moſt Part gives the Capacity of Caſks nearer the Truth than the Theorem of *Oughtred*, who ſuppoſes Caſks to be Fruſta of *Spheroids*; or than that of others, *by multiplying the Circles at the Bung and Head into half the length of the Caſk*, which ſuppoſes it to be a *Parobolick Conoid:* Or laſtly, than with others, to ſuppoſe them for Fruſta of *Cones*; which is fartheſt of all from the Truth.

The common Rule for all *Ale* or *Wine Caſks*, is to take the Diameters at the Bung and at the Head; by which you muſt find the *Areas* of the Circle there; then you muſt take $\frac{2}{3}$ of the *Area* of the Circle at the Bung, and $\frac{1}{3}$ of the *Area* of the Circle at the Head, and add them together into one Sum, which Sum multiplied by the internal length of the Caſk, gives the Content in ſolid Inches: Which you may turn into Gallons, by dividing by 282 for *Ale*, and 231 for *Wine* Gallons.

But certainly 'tis eaſier and ſhorter to uſe the Theorem, as Mr. *Oughtred* expreſſes it, as abovefaid, *viz.* $\frac{1}{3} p \times 2 \odot CE + HG$, than to make Fractions of the *Areas* of the Circles, as in the common way.

GAUGING. On this Subject, the following Authors may be conſulted.

Stereometrical Propoſitions, variouſly applicable, but particularly intended for *Gauging*: By *Robert Anderſon*. *Lond.* 1688. 8*vo.*

Gauging Promoted; being an Appendix to the former Book. *Lond.* 1669.

Smith's Practical Gauging.

Jones's Guide to the young Gauger.

Kepleri Stereometria Nova.

Mayne's Practical Gauger.

Hunt's Practical Gauging.

Newton's Gauging.

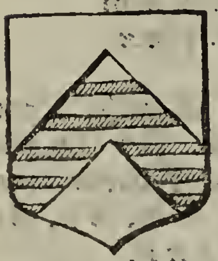
Everard's Gauging.

GAYNAGE, in our Law, ſignifies moſt properly, the Profit that comes by the Tillage of the Land held by the baſer kind of Soke-men.

GAZONS, [in *Fortification*,] are Pieces of freſh Earth covered with Graſs cut in form of a Wedge, about a Foot long, and half a Foot thick, to line Parapets and the Tranſverſes of Galleries.

GELATINOUS, [in *Medicine*,] a Term apply'd by Phyſicians to any Thing which approaches to the glutinous Conſiſtence of a Gelly.

GELD, the ſame with *Gild*, or *Guild*.



GEMELLES, the Term in Heraldry for the bearing of Bars by Pairs or Couples in a Coat of Arms: As,

He beareth *Gules on a Chevron Argent, three Bars Gemelles Sable*, by the Name of *Throgmorton*.

GEMELLUS, is a Muſcle of the Cubit, ſo called from its double Origin; it ariſeth firſt tendinous from the ſuperior Part of the inferior *Coſta* of the *Scapula* internally, and as it paſſeth between the two round Muſcles, it grows fleſhy, and in its Deſcent joineth with its other Beginning, which ariſes broad and fleſhy from the upper and back-part of the *Os Humeri*, under the *Deltoid* Muſcle; and being tendinous on the outſide, and fleſhy within, is ſo inſerted to the ſuperior and external Part of the *Ulna*, called *Olecranum* and *Ancon*, or the Elbow. Its Uſe is to extend the *Cubit*. If we examine the two Beginnings of this Muſcle, we ſhall find them interwoven with various Orders of Fibres, whereby it is rendred capable of performing the Extenſion of the *Cubit* with a greater Strength; which appears in Tumblers when they are walking on their Hands, who by an immediate Extenſion of their *Cubits*, can return to their Feet. *L.*

GEMINI, a Muſcle ſerving to move the Thigh outwards. *L.*

GEMINI, one of the 12 Signs of the *Zodiack*, being the Third in Order; alſo a Conſtellation of that Name.

GEMINOUS *Arteries*, ſo ſome call the two ſmall Arteries which deſcend to the Joint of the Knee, between the Proceſſes of the Thigh-bones.

GEMMA, among the Botaniſts, is the turgid Bud of any Tree when it is beginning to bear. 'Tis called alſo *Oculus*. L.

GEMMA, or *Sal gemma*, [in *Medicine*,] Rock Salt, or Salt dug out of the Mines, it is ſo call'd on account of its Luſtre and Brillant; much like that of Chryſtal. It is uſed for powdering and pickling Fleſh Meats, in Places that are deſtitute of Salt Springs. The principal Mines of this Salt are found in *Wiliſca* in *Poland*, of *Eperick* in upper *Hungary*; and at *Cardonna* in *Catalonia.*

GEMOTE, is an old *Saxon* Term for what we now call a Court: 'Tis often uſed in the Laws of *Edward the Confeſſor*.

GENA *Mala*, is the Part of the Face from the Noſe to the Ears: alſo the Chin and the Jaw-bone is ſometimes ſo called, which is either upper or lower. *L. Blanchard.*

GENDER, [in *Grammar*,] a Diſtinction of Names or Nouns, according to the different Sexes of the Things they denote.

GENDER, [with *Geometricians*:] Geometrical Lines are diſtinguiſhed into Genders, Claſſes, or Orders, according to the number of the Dimenſions of an Equation, expreſſing the relation between the Ordinates.

GENERAL. When an Army is preparing to march, the Drums beat a peculiar Sound, in order to acquaint the whole Army, that they ſhould all get ready to march: and this Notice by the Drum, they call *Beating the General.*

GENERALE, the ſingle Commons, or ordinary Proviſion, of the Religious in Convents, was formerly call'd by this Term *Generale*, as being their *general Allowance*; and ſo diſtinguiſh'd from their *Pittantiæ*, or *Pittances*, which, on extraordinary Occaſions, were added as over Commons.

GENERAL *Iſſue*: See *Iſſue*.

GENERATING *Line or Figure*, in *Geometry*, is that which by its Motion or Revolution produces any other Figure Plane or Solid. Thus a Right Line moved any way parallel to it ſelf, *generates* a Parallelogram; if round a Point in the ſame Plane, with one End faſtened in that Point, it *generates* a Circle. One entire Revolution of a Circle in the ſame Plane, *generates* the Cycloid; the Revolution of a Semi-circle round its Diameter, *generates* a Sphere, &c. Sir *Iſaac Newton* uſes the Word

GENERATED, or *genited Quantity*, in a very large Senſe, for whatever is produced either in *Arithmetick* by the Multiplication, Diviſion, or Extraction of Roots; or in *Geometry* by the Invention of the Contents, Areas, and Sides; or of Extreme and Mean Proportionals, without Addition and Subtraction.

GENERATION, is the Production of any thing in a natural way, which before was not in Being: For when in any Parcel of Matter there is produced ſuch a Concurrence of all thoſe Accidents which ('tis agreed) are neceſſary and ſufficient to conſtitute a *determinate Species* of things Corporeal; we then ſay a Body belonging to that Species is generated. So that here, properly ſpeaking, no *New Subſtance*, but only a new *Eſſential Denomination*, *Modification*, or *Manner of Exiſtence*, is produced or generated: And when that Union of Accidents which denominates a Body generated, is deſtroyed and diſſolved, that Body loſing its Eſſential Modification is ſaid to be corrupted.

Generation. As to what the Moderns, from their Diſcoveries by Microſcopes, have advanc'd on this Subject, you will find by comparing the Obſervations and Diſcoveries of Dr. *Harvey*, *S. Malpighii*, Dr. *De Graef*, and *M. Leeuwenhoek*, with one another: and theſe three Things ſeem to me very probable. 1. That *Animals* are *ex Animalculo*. 2. That the *Animalcules* are originally *in Semine Marium*, *& non in Fœminis*. 3. That they can never come forward, nor be formed into *Animals* of the reſpective Kind, without the *Ova in Fœminis*.

The firſt of theſe ſeems probable from theſe three Obſervations; 1. That ſome ſuch Thing has been ſo often obſerv'd by *Malpighius*, in the *Cicatricula* of an Egg before Incubation, as the Rudiments of an *Animal* in the Shape of a *Tadpole*; as may be ſeen in his firſt, and in his repeated Obſervations *de Formatione Pulli in Ovo*. 2. The ſudden appearance and diſplaying of all the Parts, after Incubation, makes it probable, that they are not then actually formed out of a Fluid, but that the *Stamina* of them have been formerly there Exiſtent, and are now expanded. The firſt part of the *Chick* which is diſcovered with the naked Eye, is, you know, the *Punctum Saliens*, and that not till three Days and Nights of Incubation be paſt; and then on the fifth Day the Rudiments of the Head and Body do appear. This made Dr. *Harvey* conclude, that the Blood had a Being before any other Part of the Body, and that from it all the Organs of the *Fœtus* were both formed and nouriſhed; but by *Malpighius*'s Obſervations, we find that the Parts are then only ſo far extended, as to be made viſible to the naked Eye, and that they were actually exiſtent before, and diſcernable by Glaſſes. After an Incubation of thirty Hours, are to be ſeen the Head, the Eyes, and the *Carina*, with the *Vertebra*, diſtinct, and the Heart. After forty Hours its Pulſe is viſible, and all the other Parts more diſtinct, which cannot be diſcern'd by the naked Eye before the beginning of the fifth Day; from whence it ſeems very probable, that even the ſo early Diſcovery of thoſe Parts of the *Fœtus* by the Microſcope, is not the diſcerning of Parts newly form'd, but only more dilated and extended by receiving of Nutriment from the *Colliquamentum*; ſo that they ſeem all to have been actually exiſtent before the Incubation of the *Hen*. And what *Swammardam* hath diſcover'd in the Tranſmutation of Inſects, gives no ſmall Light to this, whilſt he makes appear in the Explanation of the 13th Table of the *general Hiſtory of Inſects*, that in thoſe large *Eruca's* which feed upon Cabbage, if they be taken about the Time they retire to be transform'd into *Aurelia's*, and plunged often in warm Water to make a Rupture of the outer Skin, you will diſcern, through the Tranſparency of their ſecond Membrane, all the Parts of the *Butterfly*, the *Trunk*, *Wings*, *Feelers*, &c. folded up: But, that after the *Eruca* is changed into an *Aurelia*, none of theſe Parts can be diſcern'd, they are ſo drench'd with Moiſture, though they be there actually formed.

Another Conſideration is from the *Analogy*, which we may ſuppoſe between *Plants* and *Animals*. All Vegetables, we ſee, do proceed *ex Plantula*, the Seeds of Vegetables being nothing elſe but little Plants of the ſame kind folded up in Coats and Membranes; and from hence we may probably conjecture, that ſo curiouſly an organized Creature as an *Animal*, is not the ſudden Product of a Fluid, or *Colliquamentum*, but does much rather proceed from an *Animalcule* of the ſame kind, and has all its little Members folded up according to their ſeveral Joints and Plicatures, which are afterwards enlarg'd and diſtended, as we ſee in *Plants*. Now though this Conſideration alone may ſeem not to bear much Weight, yet being join'd to the two former, they do mutually ſtrengthen each other. And indeed all the Laws of Motion which are as yet diſcover'd, can give but a very lame account of the forming of a *Plant* or *Animal*. We ſee how wretchedly *Des Cartes* came off, when he began to apply them to this Subject. They are formed by Laws yet unknown to Mankind; and it ſeems moſt probable, that the *Stamina* of all the *Plants* and *Animals* that have been, or ever ſhall be in the World, have been formed *ab Origine Mundi*, by the *Almighty Creator* within the firſt of each reſpective Kind. And he who conſiders the Nature of *Viſion*, that it does not give us the true Magnitude, but the Proportion of Things, and that what ſeems to our naked Eye but a Point, may truly be made up of as many Parts as ſeem to us to be in the whole viſible World, will not think this an abſurd or impoſſible Thing.

But the ſecond Thing which later Diſcoveries have made probable is, that theſe *Animalcules* are originally *in Semine Marium*, *& non in Fœminis*: and this I collect from theſe Conſiderations.

1. That there are innumerable *Animalcula in Semine Maſculino Omnium Animalium*. M. *Leeuwenhoek* has made this ſo evident by ſo many Obſervations, that I do not in the leaſt queſtion the Truth of the Thing.

2. The obſerving of the Rudiments of the *Fœtus* in Eggs, which have been fœcundated by the *Male*, and the ſeeing no ſuch Thing in thoſe which are not fœcundated, as appears from *Malpighius*'s Obſervations, makes it very probable, that theſe Rudiments proceeded originally from the *Male*, and not from the *Female*.

3. The Reſemblance between the Rudiments of the *Fœtus in Ovo*, both before and after Incubation, and the *Animalcule*, makes it very probable, that they are one and the ſame. The ſame Shape and Figure which M. *Leeuwenhoek* gives us of the *Animalcule*, *Malpighius* likewiſe gives us of the Rudiments of the *Fœtus*, both before and after Incubation; yea, and even the *Fœtus's* of *Animals* do appear ſo at firſt to the naked Eye; ſo that Dr. *Harvey* doth acknowledge, that all *Animals*, even the moſt perfect, are begotten of a *Worm*.

4. This gives a rational account of many *Fœtus's* at one Birth, eſpecially that of the Counteſs of *Holland*; and how, at leaſt, a whole Cluſter of Eggs in a *Hen* are fœcundated by one Coition of the *Male*.

5. This gives a new Light, as it were, to the firſt Prophecy concerning the *Meſſiah*, that the *Seed of the Woman ſhall bruiſe the Head of the Serpent*: all the reſt of Mankind being thus moſt properly and truly the *Seed of the Man*.

6. The *Analogy* I have already mention'd, which we may rationally ſuppoſe between the manner of the Propagation of *Plants* and *Animals*, does likewiſe make this probable. Every *Herb* and *Tree* bears its *Seed after its Kind*; which *Seed* is nothing elſe but a *little Plant* of the ſame kind, which being thrown into the Earth, as into its *Uterus*, ſpreads forth its Roots, and receives its Nouriſhment, but has its Form within its ſelf; and we may rationally conjecture ſome ſuch *Analogy* in the Propagation of *Animals*.

The third Particular, which later Diſcoveries make probable, is, That *Animals* cannot be formed of theſe *Animalcula* without the *Ova in Fœminis*, which are neceſſary for ſupplying them with proper Nutriment; and this, theſe Conſiderations ſeem to evince. 1. It is probable that an *Animalcule* cannot come forward if it do not fall into a proper *Nidus*. This we ſee in the *Cicatricula* in Eggs; and tho' a Million of them ſhould fall into one Egg, none of them would come forward, but what were in the Centre of the *Cicatricula*; and perhaps the *Nidus*, neceſſary for their Formation, is ſo proportioned to their Bulk, that it can hardly contain more than one *Animalcule*; and this may be the Reaſon why there are ſo few *Monſters*. This we ſee is abſolutely neceſſary in *Oviparis*; and the only Difference which ſeems to be between them and the *Vivipara* in this Matter, is in this, That in the latter the *Ova* are properly nothing more but the *Cicatricula*, with its *Colliquamentum*, ſo that the *Fœtus* muſt ſpread forth its Roots into the *Uterus* to receive its Nouriſhment; but the Eggs in *Oviparis* may be properly termed an *Uterus* in relation to the *Fœtus*; for they contain not only the *Cicatricula* with its *Amnion* and *Colliquamentum*, which is the immediate Nouriſhment of the *Fœtus*, but alſo the Materials which are to be converted into that *Colliquamentum*; ſo that the *Fœtus* ſpreads forth its Roots no farther than into the White and Yolk of the Egg, from whence it derives all its Nouriſhment. Now that an *Animalcule* cannot come forward without ſome ſuch proper *Nidus*, M. *Leeuwenhoek* will not readily deny; for if there were nothing needful but their being thrown into the *Uterus*, I do not ſee why many Hundreds of them ſhould not come forward at once, at leaſt whilſt ſcatter'd in ſo large a Field.

Now, 2. That this *Cicatricula* is not originally in *Utero*, ſeems evident from the frequent Conceptions which have been found *extra Uterum*: Such as the Child which continued 26 Years in the Woman of *Tholouſe's* Belly; and the *little Fœtus* found in the *Abdomen* of *Mad. de S. Mere*, together with the Teſticle torn, and full of clotted Blood; ſuch alſo ſeem to be the *Fœtus* in the *Abdomen* of the Woman of *Copenhagen*, mentioned in the *Nouvelles des Lettres*, for *Sept.* 85. all the Members of which were eaſily to be felt thro' the Skin of the Belly, and which ſhe had carried in her Belly for four Years: And the ſeven Years Gravidation related by Dr. *Cole*. Now granting once the Neceſſity of a proper *Nidus*, for the Formation of an *Animalcule* into the *Animal* of its reſpective Kind, theſe Obſervations make it probable, that the *Teſtes* are the *Ovaria* appropriated for this Uſe; for though the *Animalcules* coming thither in ſuch Caſes, may ſeem to be extraordinary, and that uſually the Impregnation is *in Utero*, yet it may be collected from hence, that the *Cicatriculæ* or *Ova* to be impregnated, are *in Teſtibus Fœmineis*; for if it were not ſo, the accidental coming of *Animalcules* thither, could not make them come forward more than in any other Part of the Body, ſince they cannot be formed and nouriſhed without a proper *Nidus*.

But, 3. It is acknowledg'd by all, that the *Fœtus in Utero*, for ſome conſiderable Time after Conception, has no Connexion with the Womb; that it ſits wholly looſe to it, and is perfectly a little round Egg with the *Fœtus* in the midſt, which ſends forth its umbilical Veſſels by Degrees, and at laſt lays hold on the *Uterus*. Now from hence it ſeems evident, that the *Cicatricula*, which is the Fountain of the *Animalcule's* Nouriſhment, does not ſprout from the *Uterus*, but has its Origin elſewhere, and falls in thither as into a fit Soil, from whence it may draw Nutriment for the growth of the *Fœtus*; elſe it cannot be eaſily imagined how it ſhould not have an immediate Connexion with the *Uterus* from the Time of Conception.

If you join all theſe three Conſiderations together, *viz.* that an *Animalcule* cannot come forward without a proper *Nidus*, or *Cicatricula*; that there have been frequent *Fœtus's extra Uterum*; and that they have no adheſion to the *Uterus* for a conſiderable Time after Conception; they ſeem to make it evident, that *Animals* cannot be formed *ex Animalculis* without the *Ova in Fœminis*. To all theſe I ſhall ſubjoin the Propoſal of an *Experimentum Crucis*, which may ſeem to determine whether the *Teſtes Fœmineæ* be truly the *Ovaria*; *viz.* Open the *Abdomen* of the Females of ſome Kinds, and cut out theſe Teſticles, and this will determine whether they be abſolutely neceſſary for the Formation of *Animals*.

It is indeed difficult to conceive, how theſe Eggs ſhould be impregnated *per Semen Maris*, both becauſe there is no Connexion between the Tube and the Ovary for its Tranſmiſſion; and for that Dr. *Harvey* could never diſcover any thing of it *in Utero*. But as to the laſt, M. *Leeuwenhoek* has cleared that Difficulty, by the Diſcovery of innumerable *Animalcula Seminis Maris in Cornibus Uteri*, and thoſe living a conſiderable time after Coition. And as to the former, we may either ſuppoſe that there is ſuch an Inflation of the *Tubæ*, or *Cornua Uteri*, *tempore Coitionis*, as makes them embrace the *Ovaria*, and ſuch an approach of the *Uterus* and its *Cornua*, as that it may eaſily tranſmit the Seed into the Ovary: Or elſe, that the *Ova* are impregnated by the *Animalcules* after they deſcend into the *Uterus*, and not in the *Ovary*. The former ſeems probable for this Reaſon, that at leaſt a whole Cluſter of Eggs in a *Hen* will be fœcundated by one Thread of the Cock; now the Fœcundation ſeems to be in the *Vitellary*, and not in the *Uterus*, as the Eggs paſs along from Day to Day: For it can hardly be ſuppoſed that the *Animalcules* ſhould ſubſiſt ſo long, being ſcatter'd looſely in the *Uterus*, as to wait there, for many Days, for the Fœcundation of the Eggs as they paſs along. The latter Conjecture hath this to ſtrengthen it; That the *Animalcules* are found to live a conſiderable Time in the *Uterus*, and that if they ſhould impregnate the *Ova* in the *Ovary* it ſelf, the *Fœtus* would encreaſe ſo faſt, that the *Ova* could not paſs through the *Tubæ Uteri*, but would either burſt the *Ovary*, or fall down into the *Abdomen* from the Orifices of the *Tubæ*; and that from hence proceed thoſe extraordinary Conceptious *in Abdomine extra Uterum*.

But M. *Leeuwenhoek*, to weaken this Conſideration about the Conception's being like unto an *Ovum* in the Womb, propoſes a Parallel between theſe *Animalcules* and *Inſects*, and inſinuates, that as the latter caſt their Skins, and appear of another Shape, ſo the other, which at firſt ſeem like *Tadpoles*, may caſt their outer Skin, and then be round; and that this may be the Occaſion of the round Figure of the Conception in the Womb. To this it may be replied, That according to M. *Leeuwenhoek's* own Sentiment, the *Animalcules* cannot come forward, if they do not find the

Punctum or proper Place for their Nouriſhment, to which it ſeems they muſt have ſome *Adheſion.* Now the Conception in *Viviparis* is not faſtened unto the Womb for many Days, nor does adhere to any Point of it; ſo that it ſeems this roundiſh Body is not the *Animalcule* thus changed after having caſt an outer Skin, but is rather the *Cicatricula*, or little Egg, into which the *Animalcule* has enter'd as its *Punctum*, or Place of Nouriſhment; elſe I do not ſee why they ſhould not be adhering to the Womb from the firſt Conception; or why (as I have ſaid) many Hundreds of them are not conceived and formed together.

GENEROSA, a Law Term for a Gentlewoman; if ſhe be really ſo, and named *Spinſter* in any original Writ, Appeal, or Indictment, ſhe may abate and quaſh the ſame; for ſhe hath as good Right to that Addition, as a Baroneſs or Dutcheſs have to theirs: The ſame may be ſaid of *Generoſus*, a Gentleman. 2 *Inſt.* 668. *L.*

GENESIS, [γένεσις, Gr.] in Geometry, is the Formation of any Plane or ſolid Figure by the Motion of ſome Line or Surface, which Line or Surface is always called the *Deſcribent*; and that Line according to which the Motion is made, is called the *Dirigent.*

GENETHLIACI, [γενέθλιακοὶ of γενέθλη, Gr. a Nativity,] Aſtrologers, or thoſe Perſons who erect Horoſcopes, in order to predict what ſhall befall Men, *&c.* by means of the Planets or Stars that preſided at their Nativities.

GENICULUM, [in *Botany*,] is the Knot or Joint in the Stalk of any Plant. *L.*

GENIOGLOSSUM, [γενειογλωσσον of γενειον the Chin, and γλῶσσα, Gr. the Tongue,] is a Pair of Muſcles proceeding inwardly from the fore-part of the lower Jaw, under another Pair called *Genioboydes*, and enlarging themſelves, are faſtened into the Baſis of the Tongue: Theſe ſerve to pull the Tongue forward, and to thruſt it out of the Mouth.

GENIOHYOIDEUS, [of γενειον the Chin, and ὑοιδὲς a Bone of the Tongue, called *Hyoides*,] is a Muſcle of the *Os Hyoides*, which, with its Partner, is ſhort, thick, and fleſhy, ariſing from the internal Parts of the lower Jaw-bone called the Chin, and dilating themſelves, are ſoon leſſened again, and inſerted to the ſuperior Part of the Fore-bone of the *Os Hyoides*. Theſe acting, pull the *Os Hyoides*, *&c.* both upwards and forwards, and aſſiſt the *Genioglоſſa* in thruſting the Tongue out of the Mouth.

GENITALIA, [in *Anatomy*,] the *Teſtes* or Teſticles of a Man, ſo called on account of their Office in Generation; they are alſo call'd *Genitores.*

GENITURA: See *Seed.*

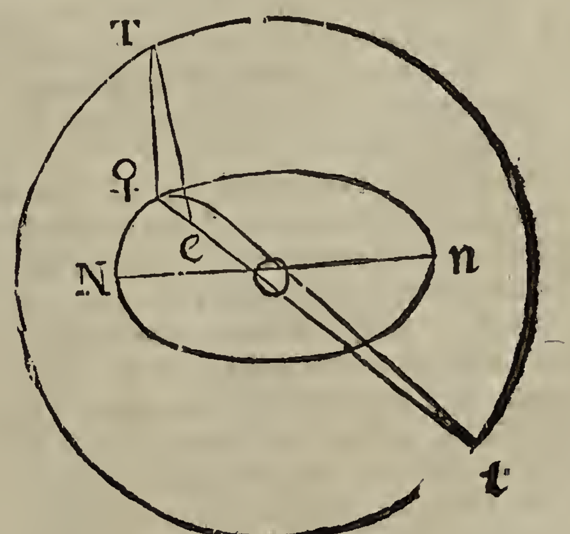
GENTLEMAN, is derived from the *French Gentil*, *i. e. Honeſtus*, *vel Honeſto loco natus*; and the *Saxon* Word *Man*: So that it ſignifies a Man well born. So the *Italians* call ſuch Perſons *Gentil Huomoni*: And the *Spaniards* keep the Meaning, when they call a Gentleman *Hidalgo*, or *Hijo d' algo*, *i. e.* the Son of *ſome Man*, or of *ſome Man of Note or Reckoning.* Under this Name with us are compriſed all above *Yeomen*; ſo that Noblemen may truly be call'd Gentlemen. But by the Courſe and Cuſtom of *England*, Nobility is either *Greater* or *Leſs*, *Upper* or *Lower.* The *greater* contains all from Knights upwards; the *leſſer* all from Barons downwards: As *Smith* ſaith, *Cap.* 21. *de Republ. Anglic.*

GENUS, [in *Logick*,] is an Idea ſo common and univerſal, that it extends it ſelf alſo to other univerſal Ideas. Thus a Right-lined Figure of four Sides, is a *Genus*, in reſpect of a *Parallelogram* or a *Trapezium.* And in like manner Subſtance is the ſame in reſpect of *Subſtance extended*, which is a Body; and *thinking Subſtance*, which is a Spirit. The Logicians divide *Genus* into *Summum* or the higheſt *Genus*, which hath nothing above it to be a *Species* of: And *ſubalternate*, which is ſometimes, or in ſome reſpects, a *Genus*, and in others a *Species.*

GEOCENTRICK, [of γη the Earth, and κέντρον, Gr. a Centre,] ſignifies any Planet or Orb that has the Earth for its Centre, or the ſame Centre with the Earth.

GEOCENTRICK *Latitude* of a Planet, is its Latitude ſeen from the Earth; or the Inclination of a Line connecting the Planet and the Earth, to the Plane of the Earth's (or true) Ecliptick: Otherwiſe 'tis the Angle which the aforeſaid Line (connecting the Planet and the Earth) makes with the Line, which is drawn perpendicular to the Plane of the Ecliptick.

Thus in the Figure annexed, the Angle ♀ *T e* is the Meaſure of the Planet ♀, her geocentrick Latitude when the Earth is in *T*, and the Angle *e t* ♀, the Meaſure of it when the Earth is in *t.*



GEOCENTRICK *Place of a Planet*, is ſuch as it would appear to us from the Earth, if our Eye were there fixed.

GEODÆSIA, [Γηωδαισία of γῆ the Earth, and δαὶω, Gr. to divide,] that Part of Geometry which contains the Doctrine or Art of *Meaſuring* Surfaces, and finding the Contents of all plain Figures.

GEODÆTICAL *Numbers*, are ſuch as are conſidered according to thoſe Vulgar Names or Denominations, by which Money, Weights, Meaſures, *&c.* are generally known, or particularly divided by the Laws and Cuſtoms of ſeveral Nations.

GEOGRAPHICAL *Mile*, is the *Sea Mile*, or *Minute*, being one 60th Part of a Degree of a great Circle on the Earth's Surface.

GEOGRAPHICAL Writers are,

Bernhardi Vareni M. D. Geographia generalis, Aucta & Illuſtrata ab Iſaaco Neutono, R. S. S. Cantab. 1672, 8*vo.*

The ſame in *Engliſh.*

Philippi Cluvitii Introductio in Geographiam Univerſam. Amſt. 1697. 4*to.*

Gordon's geographical Grammar. Edit. 2.

J. Luyt's Introductio ad Geographiam.

Cl. Ptolomæi Geograph. Lib. 8.
Strabonis Geograph.
Abr. Ortelii Theſaurus geographicus.
De la Croix, la Geographe Univerſelle. 4 *Vol.* in 8*vo.*
Cellarii Notitia Orbis Antiqui. 2 *Vol.* 4*to.*
Heylin's Coſmography, laſt Edition.

All *Atlas's* Books of *Maps*, *Charts*, &c. will be uſeful to conſult on Occaſion.

GEOGRAPHY, [γεωγραφὶα of γῆ the Earth, and γραφὴ a Deſcription, Gr.] is a Deſcription of the whole Globe of the Earth, or known Habitable World; together with all its Parts, Limits, Situations, and other remarkable Things relating thereto.

Geography is diſtinguiſhed from *Coſmography* as a Part from the Whole: *Coſmography* conſidering the whole viſible World, both Heaven and Earth. And from *Topography*, or *Chorography*, it is diſtinguiſhed as a Whole from the Part.

General GEOGRAPHY, *Univerſal* GEOGRAPHY, is that which conſiders the Earth in general, without any regard to particular Countries; or the Affections that are common to the whole intire Globe; as its Figure, Magnitude, Motions, Land, Sea, &c.

Particular GEOGRAPHY, *Special* GEOGRAPHY, conſiders the Conſtitution of ſeveral Countries or Regions, their *Figure*, *Bounds*, &c. The *Foreſts*, *Mountains*, *Mines*, *Rivers*, *Animals*, *Plants*, &c. As alſo the *Climates*, *Seaſons*, *Weather*, *Heat*, *Cold*, *Diſtance from the Equinoctial*, &c. The *Inhabitants*, *Arts*, *Communities*, *Cities*, *Commodities*, *Foods*, *Language*, *Cuſtoms*, *Policy*, *Religion*, &c.

GEOMANCY, [Γεομαντεὶα of γῆ the Earth, and μαντεία, Gr. Divination,] a kind of Divination performed by means of a number of little Points or Dots made on Paper at random; and by conſidering the various Figures that thoſe Lines repreſent, and thence forming a Judgment of future Events, and determining as to any Queſtion propos'd. The Original of this, was a Cuſtom among the antient *Greeks*, who us'd to throw Pebbles on the Ground, and to form a Judgment as to the Matters deſir'd to be known, by their Poſitions and Figures they were fancied to repreſent, as above.

GEOMETRICAL, or *Algebraical Curves*, are ſuch, as that when their Nature or Property comes to be expreſſed by an Equation, the two variable Quantities in that Equation (as x and y, the *Abſciſſa* and *Ordinate*, are called in the Doctrine of Fluxions) are both, or do both denote ſtrait Lines, then that is truly a *geometrical*, or *algebraical Curve.*

But when one of the variable or flowing Quantities in ſuch an Equation denotes a *Curve-Line*, then that Curve is called a *Tranſcendant Curve.*

GEOMETRICAL *Conſtruction of an Equation*, is the contriving and drawing of Lines and Figures, whereby to demonſtrate the Equation, Theorem, or Canon, to be geometrically true.

GEOMETRICAL *Pace*, is a Meaſure that conſiſts of five Foot.

GEOEMETRICAL *Proportionals*, are Quantities in continual Proportion, or which proceed in the ſame conſtant Ratio; as 2, 4, 8, 16, 32, 64, 128, &c.

GEOMETRICAL-*Plane*: See *Plane.*

GEOMETRICAL *Progreſſion*, or *Proportion*: See *Progreſſion.*

GEOMETRICAL *Solution of a Problem*, is when the Thing is ſolved according to the Rules of Geometry, and by ſuch Lines as are truly geometrical and agreeable to the Nature of the Problem.

Thus *Des Cartes's* Way of finding two Mean Proportionals is a *geometrical Solution*, becauſe done according to the Nature of the Problem, which is a ſolid one; and alſo becauſe performed by the *Periphery of a Circle*, and the *Parabola*, which are truly geometrical Curves, and agreeable to the Nature of the propoſed Problem: But then the Solution of it by *Diocles* is not *geometrical*, becauſe both the *Ciſſoid* (by which he perfoms it) is no true geometrical Curve, and alſo being a Line of the *Second Gender* (as they call it) it is proper only to a *ſurſolid Problem.*

GEOMETRICK *Places*: See *Places geometrical.*

GEOMETRY, [γεωμετεὶα of γῆ and μέτρον, Gr. Meaſure,] originally ſignifies the Art of meaſuring the Earth, or any Diſtances or Dimenſions on or within it; but 'tis now uſed for the *Science of Quantity*, *Extenſion*, *or Magnitude*, *abſtractedly conſidered*, *without any regard to Matter.*

Geometry, very probably, had its firſt Riſe in *Egypt*, where the *Nile* annually overflowing the Country, and covering it with Mud, obliged Men to diſtinguiſh their Lands one from another, by the Conſideration of their Figure; and to be able alſo to meaſure the Quantity of it, and to know how to plot it and lay it out again in its juſt Dimenſions, Figure, and Proportion: after which 'tis likely a farther Contemplation of thoſe Draughts and Figures, help'd them to diſcover many excellent and wonderful Properties belonging to them; which Speculations continually was improving, and is ſtill to this very Day.

GEOMETRY is uſually divided into *Speculative* and *Practical*: The former of which contemplates and treats of the Properties of continued Quantity abſtractedly: and the latter applies theſe Speculations and Theorems to Uſe and Practice, and to the Benefit and Advantage of Mankind.

GEOMETRY *Abſtruſe*: See *Tranſcendentals.*

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Ejuſdem Roſetum Geometricum. Lond. 1671. anſwer'd by Dr. *Wallis* in *Phil. Tranſ. N.* 73.
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GEORGE *Noble*, was a Piece of Gold, current in 1 *Hen.* VIII. at Six Shillings and Eight-pence: At which Time, by Indenture with the Mint, one Pound of Gold (in Weight) was to be coined into Eighty one *George Nobles*.

GEOSCOPY, [of Γῆ the Earth; and σκόπος of σκόπεω, Gr. to view,] the Conſideration or Knowledge of the Nature and Qualities of the Earth or Soil; obtain'd by viewing it.

GERMINATION, is the growing or ſprouting out of Vegetables, or of any Parts of them.

GERUND, [in *Grammar*,] a Tenſe or Time of the Infinitive in the *Latin* Tongue, like to the Participle, but undeclinable: It differs from the Participle in that it expreſſes the Time, as well as the Manner of the Action, which the Participle does not.

GIBBOUS, is a Term uſed in reference to the enlightened Parts of the Moon, while ſhe is moving from Full to the firſt Quarter; and from the laſt Quarter to Full again; for all that Time the dark Part appears horned and *falcated*, and the light one bunched out, convex, or *gibbous*.

GIFT-*Rope*, is the Boat-Rope, which is faſtened to the Boat when ſhe is *ſwifted*, in order to her being towed at the Stern of a Ship.

GILD, or *Guild*, [in *Law*,] ſignifies a Tribute, or ſometimes an Amerciament; and ſometimes alſo a Fraternity or Company combined together, with Orders and Laws made among themſelves by the Prince's Licence.

GILLA *Vitrioli*, is only a Purification of white Vitriol, by diſſolving it in the Phlegm of Vitriol, and then filtrating the Solution, and either cryſtallizing it, or evaporating *ad ſiccitatem*, to gain the Salt or *Gilla*, which accordingly will be in the form either of Cryſtals, or a dry Salt at the bottom.

GINGIVÆ, [in *Anatomy*,] the Gums; a hard ſort of Fleſh which inveſts the *Alveoli*, or Sockets of the Teeth. They are form'd by the Union of two Membranes; one of which is a Production of the internal Membrane of the Mouth. *L.*

GINGLYMUS, [γιγγλυμὸς, Gr.] is an Articulation of a Bone when it both receives and is received. Of this Articulation there are three ſorts.

The Firſt is when the End of a Bone has two Protuberances and one Cavity, and the End of the Bone which is articulated with it has two Cavities and one Protuberance, as the *Humerus* and the *Ulna*; or when a Bone at one Extremity receives another Bone, and at its other Extremity it is received by the ſame Bone, as the *Radius* and *Ulna*.

The Second Sort is when a Bone at one End receives another Bone, and at the other End is received by a third Bone, as the *Vertebræ* do.

The Third is when a Bone has a Cavity which receives the long Proceſs of another Bone, which Proceſs turns in the Cavity like the Axle-tree in a Wheel, as the ſecond *Vertebræ* of the Neck is articulated with the firſt; but this is no true *Ginglymus.*

GIRDERS, [in *Architecture,*] are the largeſt Pieces of Timber in a Floor: Their Ends are uſually faſtened into the *Summers* or *Breſt-Summers*, and the Joiſts are framed in at one End to the *Girders.* No *Girder* ſhould lie leſs than ten Inches into the Wall, and their Ends ſhould be laid in *Lome, &c.*

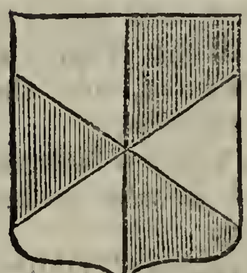
GIRDING-*Girt.* The Seamen ſay a Ship is *girt*, or hath a *Girding-girt*, when her Cable is ſo tight, or ſtrained, that upon the running of the Tide, ſhe cannot go over it with her Stern-part, but will lie a-croſs the Tides.

GIRON, GUIRON, [in *Heraldry,*] a Gore or triangular Figure, having a long ſharp Point, like the Step of a Spiral Stair Caſe, and ending in the Centre of the Eſcutcheon. The Word is *French*, and ſignifies the Lap; by reaſon in ſitting, the Knees being ſuppos'd to be ſomewhat aſunder, the two Thighs together with a Line imagined to paſs from one Knee to the other, forms a Figure, ſomething reſembling the *Giron.*

Some inſtead of *Gironne*, ſay *Parti*, *Coupe*, *Trenché*, and *Faillé*, by reaſon the *Girons* are formed by ſuch Diviſions of the Field.

When a Coat has ſix, eight, or ten of theſe *Girons* meeting or centring in the middle of the Coat, it is ſaid to be

GIRONNE, GIRONNY, [in *Heraldry,*] is when a Shield or Coat is divided into ſeveral *Girons*, which are alternately Colour and Metal; when there are eight Pieces, it is abſolutely ſaid to be *Gironne*; but when there are more or fewer, the Number is to be expreſs'd; eight *Girons* form a *Croſs*, and four a *Saltiere.*



GIVEN, is a Word often uſed in *Mathematicks*, and ſignifies ſomething which is ſuppoſed to be known: Thus, if a Magnitude be known, or that we can find another equal to it, they ſay, 'Tis a *given Magnitude*, or that ſuch a thing is *given in Magnitude.* If the Poſition of any thing be ſuppoſed as known, they ſay, *given in Poſition:* Thus, if a Circle be actually deſcribed upon any Plane, they ſay, its Centre is *given in Poſition*; its Circumference is *given in Magnitude*; and the Circle both in *Poſition and Magnitude.* But a Circle may be *given in Magnitude only*; as when only its Diameter is given, but the Circle not actually deſcribed. If the Kind or Species of any Figure be given, they ſay, *given in Specie.* If the Ratio between any two Quantities is known, they are ſaid to be *given in Proportion.* See *Barrow*'s Definitions and Propoſitions of *Euclid*'s *Data*, at the End of the Elements put forth by that great Geometrician, *Anno* 1678.

GLACIALIS *Humor:* See *Humores Oculi.*

GLACIATION, the turning of Water, or any other Liquor, into Ice. *L.* See *Freezing.*

GLACIS, a ſloping Bank in *Fortification:* It ſignifies a very gentle Steepneſs, but is more eſpecially taken for that which rangeth from the Parapet of the *Cover'd-way* to the Level on the Side of the Field.

GLACIS, an eaſy, inſenſible Slope, or Declivity.

GLACIS *of a Corniſh*, an eaſy, imperceptible Slope in the *Cymaiſe*, to promote the Deſcent and Draining off of the Rain Water.

GLAND: See *Glandula.*

GLANDS. All Secretions in an Animal Body are made by *Glands*, and a *Gland* is nothing but the Convolution or various Folding of the ſmall Arteries, whoſe laſt Branch muſt be Cylindrical. This cylindrical Artery, in its Windings, ſends out ſeveral little Ducts or ſecretory Veſſels of equal Diameters, which ſometimes unite in one common Pore, ſometimes run into a common Baſon. This Structure is evident in all the larger Glands, ſuch as the *Inteſtines*, with their ſecretory Ducts, the *Lacteals*, the *Teſticles*, and ſome of the *Conglobate Glands*, and may be ſeen in all the reſt, if they happen to be obſtructed, and ſo ſwell to become viſible; and therefore the ſame may reaſonably be concluded of all Glands in general. There are ſmall Branchings of Nerves paſſing all over the Coats of the Arteries, and ſeem to be deſigned principally for their ſpiral Contortion, that the Blood may be the more eaſily propagated through them.

A conglobate Gland is a little ſmooth Body wrapt up in a fine Skin, by which it is ſeparated from all other Parts, only admitting a Nerve and Artery to paſs in, and giving way to a Vein and Excretory Canal to paſs out: Of this Sort, are the Glands of the Brain, the labial Glands, and the *Teſtes.*

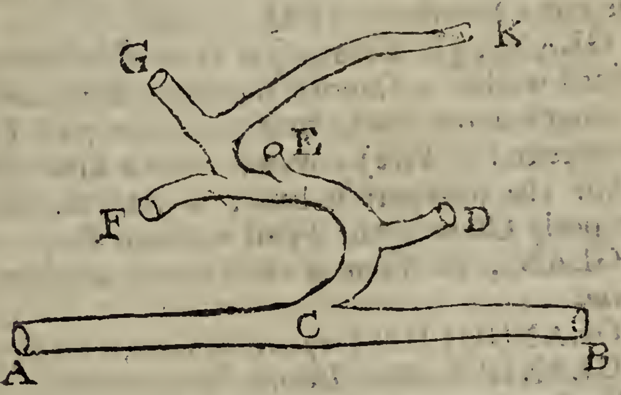
A conglomerate Gland is compoſed of many little conglobate Glands all tied together, and wrapt up in one common Tunicle or Membrane. Sometimes all their Excretory Ducts unite and make up one common Pipe, thro' which the Liquor of all of them runs, as the *Pancreas* and the *Parotides* do. Sometimes the Ducts uniting, form ſeveral Pipes, which only communicate with one another by croſs Channels; and ſuch are the *Breaſts.* Others again have ſeveral Pipes without any Communication with one another, of which Sort are the *Glandulæ Lachrymales*, and the *Proſtatæ.* And a fourth Sort is, when each little Gland hath its own Excretory Duct, thro' which it tranſmits its Liquor to a common Baſon, as in the *Kidneys.*

As to the Manner how the ſeveral Fluids, after they are form'd in the Blood, are ſeparated from it in the Glands; it depends (as Dr. *Keil* ſhews, *An. Secret.* p. 82.) entirely on the Figure and Structure of the Glands; which therefore muſt firſt be determined. As *Truth, when plain and evident, doth of it ſelf diſpel all falſe Opinions*; So *the true Structure of the Glands being once demonſtrated, there will be no Occaſion to refute the Doctrine of Ferments*, nor *the Hypotheſis of Tubes differing as to the Figures of their Orifices*; both which have ſeveral times been demonſtrated to be falſe.

That the Glands are nothing but Convolutions of ſmall Arteries, the greateſt and moſt accurate Anatomiſts of this Age, *Malpighi*, *Bellini*, and *Nuch*, have diſcover'd. And indeed, that all the Veſſels of the Body, in which the Liquors are continually moving, can have no other than a cylindrical or conical Form, is demonſtrable from the Nature of Fluids, whoſe Preſſure is always perpendicular to the Sides of the Veſſel containing them, and equal at equal Heights of the Fluid. If therefore the Sides of the Veſſels are ſoft, and equally yielding every where, (as are all the Tubes in the Body of a *Fœtus*) they muſt, by the Preſſure of their contained Fluid, be equally every where diſtended; and conſequently the Section of ſuch a Veſſel, perpendicular to its Axis, muſt be a Circle; and therefore the Veſſel muſt be either a concave Cone or Cylinder, or at leaſt ſuch a Figure whoſe Tranſverſe Section, normal to the *Axis*, muſt be a Circle.

The circular Orifices therefore of the Glands can only differ in Magnitude; and all Sorts of Particles, of a leſſer Diameter than that of the Orifice of the Gland, may enter it: So that without ſome further Contrivance, that Fluid which contains the biggeſt Particles, muſt likewiſe conſiſt of all the Particles of all the other Secretions; neither could any Fluid thicker than the Blood be ſeparated from it, becauſe of the great Proportion of the aqueous Fluid, whoſe Particles being vaſtly ſmaller than any other, and inviſible to the beſt Microſcopes, muſt enter all the Glands, and be mix'd with the ſecerned Fluid.

Now, how this Inconvenience may be prevented, and how the Particles of any Size may either be ſeparated by themſelves, or with any aſſigned Portion of the aqueous Fluid, or of other leſſer Particles, I ſhall endeavour to ſhew.



Suppoſe then *A B* to be a ſmall evaneſcent Artery, and that the Particles of the leaſt Size were to be ſeparated from the reſt.

From the Side of the Artery muſt ariſe the Gland or Tube *C K*, whoſe Orifice at *C* is ſuch as is capable of admitting only Particles of the leaſt Size, together with the aqueous Fluid: Theſe therefore will be ſeparated from all the other Particles of the Blood, and the Tube *C K* being a Cylinder, they will paſs to its further End *K*, which is ſuppoſed to be the Excretory Duct of the Gland.

If the Quantity of the aqueous Fluid, ſeparated with the leaſt Particles, muſt be diminiſh'd, that ſuch a Fluid as is requiſite may paſs through the Excretory Duct *K*, from the Tube *C K*; you muſt imagine, that ſeveral other ſmaller Canals go out, as at *D*, *E*, *F*, and *G*, whoſe Orifices are ſo ſmall, that they admit no other Particles, beſides thoſe of the aqueous Fluid, to paſs through them; and therefore as the leaſt Particles, together with the aqueous Fluid, paſs along the Tube *C K*, the aqueous Fluid muſt conſtantly be diminiſhed; and the Quantity of the leaſt Particles ſtill remaining, they can paſs no where but through the Excretory Duct at *K*: And this Diminution of the aqueous Fluid will always be according to the Number of the Canals, *D*, *E*, *F*, *G*, that is, in Proportion to the Length of the Tube *C K*. And therefore, according as the Gland is longer or ſhorter, ſo the more or leſs aqueous Fluid will paſs through the Orifice of the Excretory Duct at *K*; and conſequently, the ſecreted Fluid, on this account, be thicker or thinner.

If the Particles of a middle Size, between the biggeſt and the leaſt, are to be drawn off from the reſt of the Blood; let the Orifice at the Gland *C* be juſt ſo big as to admit thoſe Particles, and not any other of a larger Size. Theſe Particles therefore, with the aqueous Fluid, and all better Particles, will paſs through the Orifice *C*; but if the Canals *D*, *E*, *F*, *G*, are big enough to receive all the other Particles, and too little to admit thoſe that are to be ſeparated, it is evident, that thoſe Particles muſt arrive at the Excretory Duct *K*, with what Proportion of leſſer Particles is required.

And thus we ſee how any Sort of Particles may be drawn off, either by themſelves, or mixed with any others, in any Proportion: And this is done in the moſt ſimple manner, only by Arteries; for *C K* is only a ſmaller Artery, either ſtrait, ſpiral, or otherwiſe contorted, and *D*, *E*, *F*, and *G*, are again Arteries ſmaller than it; and if any of theſe are ſo ſmall as only to admit Particles of *Serum*, they will conſtitute *Lymphatick Veſſels.* From whence it is, that we find *Lymphæducts* ariſing in great Numbers from thoſe Glands that ſeparate thick Humours; as from the *Teſticles*, *Liver*, &c.

Vaſcular GLANDS, are only Cluſters of little Veſſels, which uniting together, form the Canal, or Excretory Duct, through which their ſecreted Juice is diſcharged.

Veſicular GLANDS, are Aſſemblages of *Veſiculæ*, communicating with each other, and all terminating in two or three large Veſſels; by a Prolongation of which, the Excretory Duct is formed.

Adventitious GLANDS, are thoſe Kernels which ariſe occaſionally under the Arm-pits, on the Neck, *&c.* ſuch are the *Strumæ*, and the Tumors ſometimes found on the *Larynx*, and the middle Part of the *Tracheæ.*

A Liſt of the different Sorts of Glands in a human Body, each of which filtrates a different Humour.

1. *Cerebri.*
2. *Plexus Choroidæi.*
3. *Sebaceæ.*
4. *Meatus Auditorii.*
5. *Ciliares.*
6. *Lachrymales.*
7. *Humorem Aqueum.*
8. *Cryſtalinum.*
9. *Vitreum.*
10. *Atreum Choroides.*
11. *Naſales.*
12. *Buccales*, *Labiales*, *Palatinæ.*
13. *Parotides*, *Maxillares*, *Sublinguales.*
14. *Tonſillarum.*
15. *Oeſophagi.*
16. *Aſperæ Arteriæ.*
17. *Pericardii.*
18. *Mammarium.*
19. *Ventriculi.*
20. *Inteſtinorum.*
21. *Pancreatis.*
22. *Hepatis.*
23. *Veſiculæ Fellis.*
24. *Renum.*
25. *Renales.*
26. *Uterum.*
27. *Veſicæ Urinariæ.*
28. *Urethræ.*
29. *Teſticulorum.*
30. *Proſtatarum.*
31. *Uteri.*
32. *Vaginæ.*
33. *Lymphaticæ.*
34. *Pinguedales.*
35. *Medullares.*
36. *Artuum.*
37. *Cutis Milliaris.*

GLANDULA. A *Glandule* is a Subſtance of a peculiar Nature, Fleſhy, White, or Grey; and it is two-fold: *Adventitious*, as thoſe Kernels which are ſometimes under the Arm-holes, and in the Neck, as the *King's-Evil*; a Swelling in the *Larynx* and middle of the Wind-pipe, *&c.* Or *Perpetual* and *Natural*, as the *Thymus*, *Pancreas*, *Glandula Pinealis*, *&c.* The *Perpetual* is again two-fold, either *conglobated* in one entire Piece, which ſends the ſeparated Humour into the Veins, as the Pituitary Glandule, the *Pinealis*, the Glandules of the Meſentery, of the Groin, *&c.* Or *conglomerated* in a Cluſter, which convey the Juice by their own Channels into ſome notable Cavities of the Body; as the *Pancreas*, the *Glandules of the Breaſt*, the *Salival Glandules*, *&c.* L.

There are alſo diſcovered by Dr. *Havers* a ſort of *Glands*, which he calls *Mucilaginous Glands*; which ſee under *Mucilaginous*.

GLANDULA *Guidonis*, is a Tumor like a *Glandula*, ſoft, ſingle, moveable, without Roots, and ſeparated from the adjacent Parts. *L.*

GLANDULA *Pinealis*: See *Conarium*.

GLANDULA *Pituitaria*, is a little Body in the *Sella Equina*, a Place in the Brain ſo called, cover'd over with the *Rete Mirabile* in many Brutes, but not in Men: It receives the ſerous Humour from the *Infundibulum* and the *Rete Mirabile*, which it ſends into the Jugular Veins, and the Lymphatick Veſſels. *L.*

GLANDULÆ *Lumbares*, are three Glands deſcribed by *Bartholin*, and by him ſo named, by reaſon of their lying upon the Loins: He thus deſcribes them, *Pag.* 191. of his *Anat. Edit.* 1674. The two largeſt lie one upon another betwixt the deſcending *Cava* and *Aorta*, in that Angle which the Emulgents make with the *Cava*: The third being ſmaller ſtands over theſe, under the Appendices of the Diaphragm. They have Communication, or are knit to one another by ſmall lacteal Branches, eſpecially the two larger.

He once thought them to ſupply the Place of the common Receptacle in Man; that not being ſo plain in him as in ſeveral Brutes: But ſince a Receptacle is acknowledg'd as well in Men as Brutes, Dr. *Wharton*'s Opinion concerning their Uſe ſeems more probable, *viz.*

That they ſupply the Place of thoſe larger Glands that are found in the Meſenteries of Brutes, but are not Natural to Men: and for this Reaſon he preſumes, That all ſuch Animals as want thoſe greater Glands in the Meſentery, have theſe *Lumbares* as well as Men.

GLANDULÆ *Odoriferæ* are certain ſmall Glandules diſcovered by that accurate Anatomiſt Dr. *Tyſon*, in that Part of the *Penis* where the *Præputium* is contiguous to the *Balanus*; and he gives them this Name from the great Scent which their ſeparated Liquor emits. In ſuch Perſons as have the Prepuce longer than ordinary, theſe Glands are not only more, but larger, and ſeparate a greater Quantity of their Juice, which lodging there, often grows acid, and corrodes the Glands: Theſe are very conſpicuous in moſt Quadrupedes, eſpecially in Dogs and Boars. *L.*

GLANDULÆ *Renales*, *ſeu Capſulæ Atrabilares*, are Glands which lie between the *Aorta* and the Kidneys, a little above the Emulgent Veſſels: They are two in Number, one on each Side, wrap'd up in Fat: They ſometimes change their Situation, and their Figure is alſo various; for in ſome they are round, in others oval, ſquare, triangular, of a trapezial or irregular Figure; the Right is ordinarily bigger than the Left, and each about the Bigneſs of a *Nux Vomica*. Their Uſe is not certainly known; they ſeem to ſeparate a Liquor from the arterial Blood before it goes to the Kidneys, for the liquifying the Blood which is thick after it comes from them. *L.*

GLANDULÆ *Miliares*: See *Miliares*, and *Skin*.

GLANDULÆ *Myrtiformes*, are the Contractions of the Fibres of the broken *Hymen*, upon the firſt Coition. *L.*

GLANDULÆ *Sebaceæ*, are a large number of Glands which lie under the Skin of the *Auricula* of the Ear; and which, becauſe they ſeparate a greaſy Matter, like *Tallow* or *Sebum*, their firſt Diſcoverer *Valſalva*, in his Book of the Ear, calls them by this Name. This *Sebum* being carried to the Surface of the Skin, he ſaith, hardens there, and turns into a ſcaly, greaſy Subſtance, not unlike that of Bran. Perhaps they are ſuch Glands as thoſe that ſecrete the Scurf and Dandruff that ariſes from combing the Head.

GLANDULE, [in *Anatomy*,] a little Gland, a Diminutive of the Word Gland.

GLANDULOUS, } [in *Anatomy*,] ſomething
GLANDULAR, } compos'd with Glands, or that abounds with Glands, or of the Nature of Glands.

GLANS, [in *Anatomy*,] the Tip or Button of the *Penis*, or that Part of it which is covered with the Prepuce.

GLANS, [in *Anatomy*,] the Tip or Extremity of the *Clitoris*, ſo called from its Reſemblance to the *Penis*, both as to the Form and Uſe: The Principal being this, that it is not perforated. This *Glans* is alſo covered with a *Præputium*, form'd of the inner Membrane of the *Labia*.

GLANS, [in *Botany*,] is that which being contained within a ſmooth but hard Bark, and containing but one Seed, hath its hinder-part (which adheres to the Tree) covered with a kind of Cup, while the fore-part is bare; as Acorns, *&c.* but properly *Glans* is the Fruit without Cup. *L.*

GLANS, the ſame with *Balanus* and *Suppoſitorium*.

GLANDULUM *Corpus*, the ſame with *Proſtatæ*.

GLANDULOSA *Tunica Inteſtinorum*: See *Papillæ Inteſtinorum*.

GLASS *of Antimony*: See *Regulus of Antimony*.

GLASS *Drops*, or *Bubbles*, ſometimes called *Prince Rupert's Drops*; are ſmall Parcels of coarſe green Glaſs, taken out of the Pot in Fuſion at the End of an Iron Pipe; and being exceeding hot, are let fall or dropt from thence into a Veſſel of Cold Water, and ſo lie there 'till they are ſenſibly cold. Theſe exhibit a very ſurpriſing Phænomenon, *viz.* as ſoon as you break off the leaſt Bit from the Stem of it, or pecked End, the whole Bulk of the Drop flies to pieces with a briſk Noiſe, and ſome of the Pieces will be as ſmall as Duſt. Dr. *Hook*, in his *Micrographia*, hath a particular Diſſertation upon this Subject.

GLASSY *Humour of the Eye*: See *Vitreous Humour*.

GLASSY *Tunicle*: See *Vitreous Tunicle*.

GLAUCOMA, γλαύκωμα of γλαῦξ, Gr. an Owl whoſe Eyes are of that Colour, Gr.] a Defect of the Eyes, wherein the Cryſtalline Humour loſes its Tranſparency, and appears bluiſh.

GLAUCOSIS, the ſame with *Glaucoma*.

GLEBE, [in *Chymiſtry*, &c.] a Clod or Piece of Earth containing ſome Metal or Mineral.

GLEBE-*Land*, that Land that belongs to the Pariſh-Church beſides the Tithes; but in a more general and extended Senſe, the Term *Glebe* is us'd of any Land or Ground, belonging to a Benefice, Fee, Manour, Inheritance, *&c.*

GLEET, [with *Surgeons*,] a Flux of thin Humour from the *Urethra*.

GLENE, [γληνὴ, Gr.] the ſame with *Pupilla*; alſo the Cavity of a Bone which receeives another within it.

GLENOIDES, [of γληνὴ and εἶδος, Gr. Form,] are two Cavities in the lower Part of the firſt Vertebre of the Neck.

GLOBE, or *Sphere*, is a round ſolid Body, every Part of whoſe Surface is equally diſtant from a

Point within it, called its Centre: and it may be conceived to be formed by the Revolution of a Semicircle round its Diameter.

When ſuch a Body as this hath all the Parts of the Earth and Sea drawn or delineated on its Surface, like as in a Map, and placed in their Natural Order and Situation, it is called the *Terreſtrial Globe.*

But if on its Surface it hath the fixed Stars and the Images of the Conſtellations drawn, together with the Circles of the Sphere below deſcribed, 'tis then called the *Celeſtial Globe.*

And when the following Circles are ſuppoſed to be deſcribed on the Convex Surface of a Sphere, which is hollow within, and after this you imagine all Parts of the Sphere's Surface to be cut away, except thoſe Parts on which ſuch Circles are deſcribed, then that Sphere is called an *Armillary Sphere*, becauſe it appears in the Form of ſeveral Circular Rings or Bracelets put together in a due Poſition.

There are Ten Eminent Circles upon the Globe or of the Sphere; Six of which are called *Greater*, and the Four other *leſſer Circles.*

A *great Circle* of the Sphere is that whoſe Plane paſſeth through the Centre of the Sphere, and divides it into two equal Parts or Hemiſpheres.

A *leſſer Circle* is that which is parallel to a *greater*, as the *Tropicks* and the *Polar Circles* are to the *Equator*, and as the *Circles of Altitude* are to the *Horizon.*

Or *leſſer Circles* are ſuch as do not divide the Globe into two equal Parts.

The greater Circles are,

I. The ***Horizon***, which is a broad wooden Circle encompaſſing the Globe round about, having two Notches, the one in the North, the other in the South Part of it, for the Brazen *Meridian* to ſtand in.

There are uſually accounted two *Horizons:*

Firſt, The *Viſible*, or *Senſible*, which you may conceive to be made by ſome great Plain, or the Surface of the Sea; and which divides the Heavens into two *Hemiſpheres*, the one above, the other (apparently) below the Level of the Earth.

This Circle determines the Riſing and Setting of the Sun, Moon, or Stars, in any particular Latitude; for when any one of them comes juſt to the Eaſtern Edge of the *Horizon*, then we ſay it Riſeth; and when it doth ſo at the Weſtern Edge, we ſay it Setteth. And from hence alſo the Altitude of the Sun and Stars is accounted, which is their Height in Degrees above the Horizon.

II. The other *Horizon* is called the *Real* or *Rational*, and is a Circle which encompaſſes the Earth exactly in the middle, and whoſe Poles are the *Zenith* and *Nadir*; that is, two Points in its *Axis*, each 90 Degrees diſtant from its Plane, (as the Poles of all Circles are) and the one exactly over our Heads, and the other directly under our Feet. This is the Circle which the Wooden Horizon on the Globe repreſents.

On which *broad Horizon* ſeveral Circles are drawn, the innermoſt of which is the Number of Degrees of the *Twelve Signs* of the *Zodiack, viz.* 30 to each Sign: For the ancient Aſtronomers obſerved the Sun in his (apparent) annual Motion, to deſcribe always one and the ſame Line in Heaven, and never to deviate from this Track or Path to the North or South, as all the other Planets did more or leſs; and becauſe they found the Sun alſo to ſhift, as it were backward, through all the parts of this Circle or Path, ſo that in his whole Year's Courſe he would *Riſe*, *Culminate*, and *Set* with every Point of it; they diſtinguiſhed the fixed Stars that appeared in or near this Circle into *Twelve Conſtellations* or Diviſions, which they called *Signs*; and becauſe they were moſt of them uſually drawn in the Form of *Animals*, they called this Circle by the Name of the *Zodiack*, and the very middle Line of it the *Ecliptick:* And ſince every Circle was divided into 360 Parts or Degrees, a twelfth Part of that Number muſt be 30, the Degrees in each Sign.

Next to this you have the Names of thoſe Signs; next to this the Days of the Month, according to the *Julian Account*, or *Old Stile*, *with the Calendar*; and then another *Calendar* according to the *Foreign Account*, called the *New Stile.*

And without theſe is a Circle divided into thirty two equal Parts, which make the thirty two Rhombs or Points of the Mariner's Compaſs, with the firſt Letters of the Names annexed; and ſince a thirty ſecond Part of 360 Degrees is 11 Degrees 15 Minutes, they account that each ſingle Point of the Compaſs is 11 Degree 15 Minutes.

The Uſes of this Circle in the Globe, are,

1. To determine the Riſing and Setting of the Sun, Moon, or Stars, and to ſhew the Time of it by the help of the Hour-Circle and Index; as ſhall be ſhewed hereafter.

2. To limit the Increaſe and Decreaſe of the Day and Night: For when the Sun riſes due Eaſt, and ſets Weſt, the Days are equal.

But when he Riſeth and Setteth to the North of the Eaſt and Weſt, the Days are longer than the Nights; as, on the contrary, the Nights are longer than the Days, when the Sun Riſeth and Setteth to the Southward of the Eaſt and Weſt Points of the Horizon.

3. To ſhew the amplitude of the Sun, or of any Star; and alſo, on what Point of the Compaſs it Riſeth and Setteth.

II. The next *great Circle* is the *Meridian*, which is repreſented by the Brazen Frame or Circle in which the Globe hangs and turns: This is divided into four Nineties, or 360 Degrees, beginning at the *Equinoctial.* 'Tis called the *Meridian*, becauſe when the Sun comes to the South Part of this Circle 'tis then *Meridies*, *Mid-Day*, or *High-Noon*, and then the Sun hath its greateſt altitude for that Day, which therefore is called the *Meridian Altitude.* The Plane of this Circle is perpendicular to the *Horizon*, and paſſeth through the South and North Points thereof, through the *Zenith* and *Nadir*, and through the Poles of the World. In it, each way from the *Equinoctial* on the *Celeſtial Globe*, is accounted the North or South Declination of the Sun or Stars; and on the *Terreſtrial*, the Latitude of a Place North or South; which is all one Quantity with the elevation or height of the Pole above the *Horizon:* Becauſe the diſtance from the *Zenith* to the *Horizon*, being the ſame as that between the *Equinoctial* and the *Poles*, if from each you imagine the diſtance from the *Pole* to the *Zenith* to be taken away, the Latitude muſt remain equal to the *Pole's Height.*

There are two Points of this Circle, each 90 Degrees from the *Equinoctial*, which are called the *Poles of the World*; and a Diameter from thence continued through the centre of either Globe, is called the *Axis of the Earth* or *Heavens*, on which they are ſuppoſed to turn round.

Theſe *Meridians* are various, and change according to the Longitude of Places; for as ſoon as ever a Man moves but one Degree, or but a Point to the Eaſt or Weſt, he is under a new Meridian: But there is, (or ſhould be) one fix'd, which is called the *Firſt Meridian.*

And this on ſome Globes paſſes through *Gratioſa*, one of the *Azores* Iſlands; but the *French* place the firſt Meridian at *Fero*, one of the *Canary* Iſlands.

The Poles of the Meridian are the Eaſt and Weſt Points of the *Horizon.*

On the *Terreſtrial Globe* there are uſually drawn twenty four Meridians, one through every 15 Degrees of the Equator, or through every 15 Degrees of Longitude.

The Uſes of this Circle are,

Firſt, To ſet the Globe to any particular Latitude, by a proper elevation of the Pole above the *Horizon* of that Place: And,

Secondly, To ſhew the Sun or Stars Declination, right Aſcenſion, and greateſt Altitude; of which more below.

III. The next *great Circle* is the *Equinoctial*, as it is called on the celeſtial, and *Equator* on the terreſtrial Globe. This is a great Circle, whoſe Poles are the Poles of the World: It divides the Globe into two equal Parts or Hemiſpheres, as to North and South; and it paſſes through the Eaſt and Weſt points of the *Horizon*, and at the Meridian is always as much raiſed above the *Horizon*, as is the Complement of the Latitude of any particular Place. Whenever the Sun comes to this Circle, it makes equal Days and Nights all round the Globe, becauſe it always riſeth then due Eaſt, and ſets due Weſt, which it doth at no other time of the Year. All Stars alſo which are under this Circle, or which have no Declination, do always riſe due Eaſt, and ſet full Weſt.

All People living under this Circle (which in Geography, or rather by Navigators, is called the *Line*) have the Days and Nights conſtantly equal; and when the Sun is in the Equinoctial, he will be at Noon in their *Zenith*, or directly over their Heads, and ſo their erect Bodies can caſt no Shadow.

From this Circle, both ways, the Sun or Star's Declination on the Celeſtial, or Latitude of all Places on the *Terreſtrial Globe*, is accounted on the Meridian: and ſuch leſſer Circles as run through each Degree of Latitude or Declination parallel to the Equinoctial, are called Parallels of Latitude, or Parallels of Declination.

Through every 15 Degrees of this Equinoctial the Hour-Circles are drawn at Right-angles to it on the *Celeſtial Globe*, and all paſs through the Poles of the World, dividing the Equinoctial into 24 equal Parts.

And the *Equator* on the *Terreſtrial Globe* is divided by the Meridian into 36 equal Parts; which Meridians are equivalent to the Hour-Circles on the other Globe.

IV. The *Zodiack* is another *great Circle* of the Sphere, dividing the Globe into two equal Parts. When the Points of *Aries* and *Libra* are brought to the Horizon, it will cut *that* and the Equinoctial obliquely, making with the former an Angle equal to the Sun's greateſt Meridian Altitude in any Latitude; and with the Equinoctial, an Angle equal to 23 Degrees and 30 Minutes, which is the Sun's greateſt Declination. This Circle by Aſtronomers is accounted as a kind of broad one, and is like a Belt or Girdle round the Globe: Through the middle of it is drawn a Line called the *Ecliptick*, or *Via Solis*, the *Way of the Sun*; becauſe the Sun never deviates from it in its annual Motion, as the Planets do all more, or leſs, whence it hath its Breadth.

This Circle is mark'd with the Characters of the *Twelve Signs*, and on it is found out the Sun's Place, which is under what Star or Degree of any of the *Twelve Zodiacal Conſtellations* he appears to be at Noon. By this are determined the Four Quarters of the Year, according as the Ecliptick is divided into four equal Parts; and according as the Sun goes on here, he hath more or leſs Declination.

Alſo from this Circle the Latitude of the Planets and fixed Stars are accounted from the Ecliptick towards its Poles.

The Poles of this Circle are 23 Degrees 30 Minutes diſtant from the Poles of the World, or of the Equinoctial, and by their Motion round the Poles of the World, are the Polar Circles deſcribed.

In theſe Poles of the Ecliptick all the Circles of Longitude which are drawn through the Zodiack do determinate, as the *Meridians* and *Hour-Circles* do in the Poles of the World, and as the *Azimuth* or *Vertical Circles* do in the *Zenith* and *Nadir.*

V. If you imagine two *great Circles* paſſing both through the Poles of the World, and alſo one of them through the Equinoctial Points, *Aries* and *Libra*; and the other through the Solſtitial Points, *Caneer* and *Capricorn:*

Theſe are called the two *Colures*, the one the Equinoctial, the other the Solſtitial *Colure.* Theſe will divide the Ecliptick into four equal Parts or Quarters, which are denominated according to the Points where theſe paſs through, called the four Cardinal Points, and are the firſt Points of *Aries*, *Libra*, *Cancer*, and *Capricorn.*

Theſe are all the Great Circles.

VI. If you ſuppoſe two Circles drawn parallel to the Equinoctial, at 23 Degrees 30 Minutes diſtant from it, one towards the North, the other towards the South, theſe are called the *Tropicks*, becauſe the Sun appears, when in them, to turn backward from his former Courſe; the one the Tropick of *Cancer*, and the other, the Tropick of *Capricorn*, becauſe they are under theſe Signs.

VII. If two other Circles are ſuppos'd to be drawn through 23 Degrees 30 Minutes, reckoned on the Meridian from the Polar Points, theſe are called the *Polar Circles:* The Northern is the *Artick*, and the Southern the *Antartick Circles*, becauſe oppoſite to the former.

Theſe are the four Leſſer Circles.

And theſe on the *Terreſtrial Globe* the Ancients ſuppoſed to divide the Earth into five *Zones*, viz. two *Frigid*, two *Temperate*, and the *Torrid Zone.*

Beſides theſe ten Circles lately deſcribed, which are always drawn on the Globe it ſelf, there are ſome other neceſſary Circles to be known, which are barely imaginary, and ſuppoſed only to be drawn upon the Globe.

1. *Meridians*, or *Hour-Circles*, which are great Circles meeting all in the Poles of the World, and croſſing the Equinoctial at Right-angles; theſe are ſupplied by the Meridian, Hour-Circle, and Index.

2. *Azimuths*, or *Vertical Circles*, which likewiſe are great Circles of the Sphere, and meet in the *Zenith* and *Nadir*, as the Meridians and Hour-Circles do in the Poles: Theſe cut the Horizon at Right-angles, and on theſe is reckoned the Sun's Altitude when he is not in the Meridian. They are repreſented by the Quadrant of Altitude, which being fix'd at the *Zenith*, is moveable about round the Globe through all the Points of the Compaſs.

3. There are alſo *Circles of Longitude* of the Stars and Planets, which are great Circles paſſing through the Pole of the Ecliptick, and in that Line determining the Stars or Planets Place or Longitude reckoned from the firſt Point of *Aries*.

4. *Almacanters*, or *Parallels of Altitude*, are Circles having their Poles in the *Zenith*, and are always drawn parallel to the Horizon. Theſe are *leſſer Circles of the Sphere*, diminiſhing gradually as they go farther and farther from the Horizon.

In reſpect of the Stars there are alſo ſuppoſed to be *Parallels of Latitude*, which are parallel to the Ecliptick, and have their Poles the ſame with thoſe of that Circle.

5. *Parallels of Declination* of the Sun or Stars, which are leſſer Circles, whoſe Poles are the Poles of the World, and are all drawn parallel to the Equinoctial, either North or South; and theſe (when drawn on the *Terreſtrial Globe*) are called *Parallels of Latitude*.

DEFINITIONS.

1. *Latitude of any Place*, is an Arch of the Meridian of that Place, intercepted between its Zenith and the Equator; and this is the ſame with an Arch of the Meridian, intercepted between the Pole and the Horizon; and therefore it is often expreſſed by the Poles Height, or Elevation of the Pole: The Reaſon of which is, That from the Equator to the Pole, there always being the Diſtance of 90 Degrees, and from the Zenith to the Horizon the ſame Number, and each of theſe 90 Degrees containing within it the Diſtance between the Zenith and the Pole; that Diſtance therefore being taken away from both, muſt leave the Diſtance from the Zenith to the Equator, equal to the Diſtance between the Pole and the Horizon, or to the Elevation of the Pole above the Horizon.

2. *Latitude of a Star or Planet*, is an Arch of a great Circle reckoned on the Quadrant of Altitude, laid through the Star and Pole of the Ecliptick, from the Ecliptick towards its Pole.

3. *Longitude of a Place*, is an Arch of the Equator intercepted between the Meridian of the Place and the firſt Meridian: Or it is more properly the Difference, either Eaſt or Weſt, between the Meridians of any two Places, accounted on the Equator.

4. *Longitude of a Star*, is an Arch of the Ecliptick, accounted from the beginning of *Aries* to the Place where the Star's Circle of Longitude croſſeth the Ecliptick; ſo that it is much the ſame as the Star's Place in the Ecliptick, accounted from the beginning of *Aries*.

5. *Amplitude of the Sun*, or of a *Star*, is an Arch of the Horizon intercepted between the true Eaſt or Weſt Points of it, and that Point upon which the Sun or Star riſes or ſets.

6. *Right Aſcenſion of the Sun*, or of a *Star*, is that part of the Equinoctial reckoned from the beginning of *Aries*, which riſeth or ſetteth with the Sun or Star in a Right Sphere: But in an Oblique Sphere it is that Part or Degree of the Equinoctial which comes to the *Meridian* with it, (as before) reckoned from the beginning of *Aries*.

1. *A Right or Direct Sphere*, is when the Poles are in the Horizon, and the Equator in the Zenith. The Conſequence of being under ſuch a Poſition of the Heavens as this (which is the Caſe of thoſe who live directly under the Line) is, That the Inhabitants have no Latitude nor Elevation of the Pole: They can nearly ſee both the Poles of the World: All the Stars in the Heavens do once in 24 Hours Riſe, Culminate, and Set with them; the Sun always Riſes and Deſcends at Right-angles with the Horizon, which is the Reaſon they have always equal Day and Night, becauſe the Horizon doth exactly biſſect the Circle of the Sun's Diurnal Revolution.

2. *A Parallel Sphere*, is where the Poles are in the *Zenith* and *Nadir*, and the *Equinoctial* in the Horizon; which is the Caſe of ſuch Perſons, if any ſuch there be, who live directly under the North or South Poles.

And the Conſequences of ſuch a Poſition are, That the Parallels of the Sun's Declination will alſo be Parallels of his Altitude, or Almacanters to them. The Inhabitants can ſee only ſuch Stars as are on their Side the Equinoctial; and they muſt have ſix Months Day, and ſix Months continual Night every Year; and the Sun can never be higher with them than 23 Degrees 30 Minutes, (which is not ſo high as it is with us on *February* 10th.)

3. An *Oblique Sphere*, is where the Pole is elevated to any Number of Degrees leſs than 90: and conſequently the *Axis* of the Globe can never be at Right-angles to, nor in the Horizon; and the Equator, and Parallels of Declination, will all cut the *Horizon* obliquely, from whence it takes its Name.

Oblique Aſcenſion of the Sun, or *Stars*, is that Part or Degree of the Equinoctial reckoned from the beginning of *Aries*, which Riſes and Sets with them in an oblique Sphere.

Aſcenſional Difference, is the Difference between the *Right* and *Oblique Aſcenſion*, when the Leſſer is ſubtracted from the Greater.

On the Terreſtrial Globe.

1. A Space upon the Surface of the Earth, reckoned between two Parallels to the Equator, wherein the Increaſe of the longeſt Day is a Quarter of an Hour, is by ſome Writers called a *Parallel*.

2. And the Space contained between two ſuch Parallels, is called a *Climate*: Theſe *Climates* begin at the *Equator*; and when we go thence North or South, till the Day become half an Hour longer than it was before, they ſay, we are come into the *Firſt Climate*; when the Days are an Hour longer, than they are under the *Equator*, we are come to the *Second Climate*, &c. Theſe Climates are accounted in Number 24, reckoned each way towards the Poles.

The Inhabitants of the Earth are divided into three Sorts, as to their falling of their Shadows.

1. *Amphiſcii*, who are thoſe which inhabit the *Torrid Zone*, or live between the Equator and Tropicks, and conſequently have the Sun twice a Year in their Zenith; at which time they are *Aſcii*, i. e. have no Shadows, the Sun being Vertical to them. Theſe have their Shadows caſt to the Southward, when the Sun is in the Northern Signs; and to the Northward, when the Sun is in the Southern Signs, reckoned in reſpect of them.

2. *Heteroſcii*, who are thoſe whoſe Shadows fall but one way; as is the Caſe of all ſuch as live between the Tropick and Polar Circles: For their Shadows at Noon are always to the Northward in North Latitude, and to the Southward in South Latitude.

3. *Periſcii*, are ſuch Perſons that inhabit thoſe Places of the Earth that lie between the Polar Circles and the Poles, and therefore have their Shadows falling all manner of ways, becauſe the Sun at ſome times of the Year goes clear round about them.

The Inhabitants of the Earth, in reſpect of one another, are alſo divided into three Sorts.

1. *Periœci*, who are ſuch as inhabiting the ſame Parallel, (not a *great Circle)* are yet directly oppoſite to one another, the one being Eaſt or Weſt from the other exactly 180 Degrees, which is their Difference of Longitude: Now theſe have the ſame Latitude and Length of Days and Nights, but exactly at contrary Times; for when the Sun Riſeth to one, it Sets to the other.

2. *Antœci*, who are Inhabitants of ſuch Places, as being under a Semicircle of the ſame *Meridian*, do lie at equal Diſtances from the *Equator*, one towards the North, and the other towards the South.

Now theſe have the ſame Degree of Latitude, but towards contrary Parts, the one North, and the other South; and therefore muſt have the Seaſons of the Year directly at contrary Times one to the other.

3. *Antipodes*, who are ſuch as dwell under the ſame Meridian, but in two oppoſite and equi-diſtant Parallels, and in the two oppoſite Points of thoſe two Parallels; ſo that they go Feet againſt Feet, and are diſtant from each other an entire Diameter of the Earth, or 180 Degrees of a great Circle.

Theſe have the ſame Degree of Latitude, but the one South, the other North, and accounted from the *Equator* a quite contrary way; and therefore theſe will have all Things, as Day and Night, Summer and Winter, directly contrary to one another.

PROBLEMS.

I. *To find the Latitude of any Place.*

Bring the Place to the Braſs Meridian, and the Degrees of that Circle, intercepted between the Place and the Equinoctial, are the Latitude of that Place either North or South.

Then to fit the Globe ſo that the *Wooden Horizon* ſhall repreſent the Horizon of that Place, elevate the Pole as many Degrees above the *Wooden Horizon*, as are the Latitude of that Place, and it is done; for then will that Place be in the Zenith.

If after this you rectify the Globe to any particular Time, you may by the Index know the Time of Sun-riſing and Setting with the Inhabitants of that Place, and conſequently the preſent Length of their Day and Night, &c.

PROBLEM II.

To find the Longitude of Places.

Bring the Places ſeverally to the Braſs Meridian, and then the Number of Degrees of the *Equinoctial*, which are between the Meridians of each Place, are their *Difference of Longitude* either Eaſt or Weſt.

But if you reckon it from any Place where a *Firſt Meridian* is ſuppoſed to be placed, you muſt bring that *Firſt Meridian* to the Brazen one on the Globe; and then turning the Globe about, 'till the other Place come thither alſo, reckon the Number of Degrees of the *Equinoctial*, intercepted between that *Firſt Meridian*, and the proper one of the Place, and that is the Longitude of that Place, either Eaſt or Weſt.

PROBLEM III.

For the Diſtances of Places on the Terreſtrial Globe.

See the *Problem* on the Celeſtial Globe, *For finding the Diſtance between two Stars.*

PROBLEM IV.

To find what Places of the Earth the Sun is Vertical to at any time aſſigned.

Bring the Sun's Place, found in the Ecliptick on the Terreſtrial Globe, to the Brazen Meridian, and note what Degree of the Meridian it cuts; then by turning the Globe round about, you will ſee what Places of the Earth are in that Parallel of Declination, (for they will all come ſucceſſively to that Degree of the Brazen Meridian) and thoſe are the Places or Parts of the Earth to which the Sun will be Vertical that Day; whoſe Inhabitants will then be *Aſcii*, that is, their erect Bodies at Noon will caſt no Shadow.

Problems on the Celeſtial Globe.

Suppoſe *May* the 10th, 1701, the Sun's Place to be juſt at the Entrance into the firſt Degree of *Gemini.*

PROBLEM I.

To rectify the Globe: Or, to render it in the General fit to reſolve any Problem; which Rectification *therefore is always ſuppoſed to be the firſt thing done: To do which,*

Bring the Sun's Place, found in the Ecliptick on the Globe, to the *Meridian*, and the Hour-Index to 12 at Noon.

PROBLEM II.

For the Sun's Declination.

Bring the Sun's Place for that Day, (which here and below is ſuppoſed to be given) to the *Meridian* as before, and then the Degrees of the *Meridian*, reckoned from the Equinoctial either North or South, are the *Sun's Declination* at Noon, either North or South, according to the Time of the Year, *viz.* from *March* the 10th, to *September* the 12th, North; and thence to *March* again South:

And the *Declination* for *May* the 10th will be 20 Degrees and about 12 Minutes North.

PROBLEM III.

For his Amplitude either Riſing or Setting.

Bring the Sun's Place to the *Horizon*, either on the Eaſt or Weſt Side, and the Degrees of the Horizon, accounted from the Eaſt Point, either North or South, are the *Amplitude* required; *viz. May* the 10th, the Sun's *Amplitude* will be 34 Degrees to the North of the Eaſt.

And at the ſame time you have in the outer Circle of Rhumbs the Point which the Sun Riſes or Sets upon, N. E. by E. or N. W. by W.

PROBLEM IV.

For his Right Aſcenſion.

Bring the Sun's Place to the *Meridian*, and the Number of Degrees intercepted between the beginning of *Aries*, and that Degree of the Equinoctial, which comes to the *Meridian* with the Sun, is the *Right Aſcenſion*.

If you would have it in Time, account every 15 Degrees to be an Hour, and every Degree to be 4 Minutes.

N. B. The Reaſon of bringing the Sun's Place to the *Meridian* in this Problem, is to ſave the Trouble of putting the Globe into the Poſition of a *Right Sphere:* For properly Right Aſcenſion is that Degree of the Equinoctial which Riſes with the Sun in a *Right Sphere*. But ſince the Equator is always at Right-angles to the *Meridian*, if you bring the Sun's Place thither, it muſt in the Equinoctial cut the Right Aſcenſion: Thus in the Inſtance of *May* the 10th, the Sun's Right Aſcenſion will be 59 Degrees, or 4 Hours wanting 4 Minutes.

PROBLEM V.

For the Oblique Aſcenſion.

Bring the Sun's Place to the *Horizon* on the Eaſt-ſide, and the number of Degrees intercepted between that Degree of the Equinoctial which is now come to the *Horizon*, and the beginning or firſt Point of *Aries* is the *Oblique Aſcenſion*. Thus, *May* the 10th, the Sun's *Oblique Aſcenſion* is 30 Degrees 15 Minutes.

Of thoſe two *Aſcenſions* take the Leſſer from the Greater, the Remainder will be,

PROBLEM VI.

The Aſcenſional Difference.

Which therefore is the Difference in Degrees between the *Right* or *Oblique Aſcenſion*, or the Space between the Sun's Riſing and Setting, and the Hour of Six: Wherefore his Aſcenſional Difference turned into Time, will give the Time of the Sun's Riſing or Setting before or after Six. Thus, from 59 Degrees take 30 Degrees 15 Minutes, there will remain 28 Degrees 45 Minutes, the *Aſcenſional Difference* in Degrees, and in Time 1 Hour 55 Minutes; and ſo much doth the Sun Riſe before Six, and Set after it.

PROBLEM VII.

For the Sun's Riſing or Setting.

Bring his Place to the Horizon, either Eaſt or Weſt, and the Hour-Index ſhall ſhew the Time either of his Riſing or Setting accordingly; which, *May* 10th, is 5 Minutes after 4 in the Morning, and 5 Minutes before 8 at Night.

The Time of the Sun's Setting doubled, gives the Length of the Day, which then will be 15 Hours 50 Minutes; and the Time of this Riſing doubled, gives the Length of the Night, which, *May* 10th, is 8 Hours 10 Minutes.

PROBLEM VIII.

Fer the Sun's Meridian Altitude, or Depreſſion at Midnight.

Bring his Place to the *Meridian*, above the *Horizon*, for his Noon Altitude, which will ſhew the Degrees of it accounted there from the *Horizon*; which, *May* the 10th, will be 58 Degrees 42 Minutes. For his *Midnight Depreſſion*, below the North Point of the *Horizon*, you muſt bring the Point in the Ecliptick, oppoſite to the Sun's preſent Place, to the South Part of the Meridian above the Horizon; and the Degrees there intercepted between that Point and the Horizon, are his *Midnight Depreſſion*; which, *May* the 10th, will be 18 Degrees 42 Minutes.

PROBLEM IX.

For the Sun's Altitude at any Time of the Day given.

Rectify the Globe, and *fit the Quadrant of Altitude*; that is, ſcrew the Braſs Quadrant of Altitude to the *Zenith*; or in our Latitude, ſcrew it ſo that the graduated Edge cut 51 Degrees 30 Minutes on the Meridian, reckoned from the Equinoctial.

Then turn about the Globe till the Index ſhew the Time propoſed, and ſtay the Globe there; after which bring the Quadrant of Altitude to cut the Sun's Place in the Ecliptick, and then that Place or Degree of the Ecliptick ſhall ſhew the Sun's Altitude on the Quadrant.

Thus, *May* the 10th, the Sun's Altitude at Nine a Clock in the Morning will be 43 Degrees 30 Minutes.

PROBLEM X.

To find the Sun's Hour or Altitude when he is due Eaſt or Weſt above the Horizon.

Rectify the Globe, and *fit the Quadrant of the Altitude*; then bring the Quadrant to cut the true Eaſt Point, and next turn the Globe about till the Sun's Place in the Ecliptick cut the graduated Edge of the Quadrant; for then that Place will ſhew the Altitude and the Index of the Hour.

Thus, *May* the 10th, the Sun will be Eaſt at 5 Minutes paſt Seven in the Morning, and his Altitude then is 26 Degrees.

PROBLEM XI.

To find the Sun's Altitude or Time of the Day on any Azimuth given: Or, When the Sun is on any given Point of the Compaſs.

Set the Quadrant of Altitude to the Azimuth given, then turn the Globe till his Place in the

Ecliptick touch the graduated Edge of the Quadrant; ſo ſhall that Place give the Altitude on the Quadrant, and the Hour-Index the Time of the Day.

Example.

May the 10th, the Azimuth being 60 Degrees from the South toward the Eaſt, or the point of the Compaſs which the Sun is then on, being S. E. by E. and near half a point more eaſterly; his Altitude will be (nearly) 46 Degrees, and the Hour of the Day a little more than a Quarter paſt Nine in the Morning.

PROBLEM XII.

To find the Declination and Right Aſcenſion of any Star.

Bring the Star to the *Meridian*, and then the Degrees intercepted between the Equinoctial and the point of the Meridian cut by the Star, are its Declination; and the Meridian cuts and ſhews its *Right Aſcenſion* on the Equinoctial, accounting it from the beginning of *Aries*.

PROBLEM XIII.

To find the Longitude and Latitude of any Star.

Bring the Solſtitial Colure to the Braſs Meridian, and there fix the Globe; then will the Pole of the Ecliptick be juſt under 23 Degrees 30 Minutes, accounted from the pole above the North point of the Horizon, and upon the ſame Meridian; there ſcrew the Quadrant of Altitude, and then bring its graduated Edge to the Star aſſigned, and there ſtay it; ſo will the Star cut its proper *Latitude* on the *Quadrant*, reckoned from the Ecliptick; and the Quadrant will cut the Ecliptick in the Star's *Longitude*, or its Diſtance from the firſt point of *Aries*.

PROBLEM XIV.

To find the Time of any Star's Riſing, Setting, or Culminating, i. e. *being on the Meridian.*

Rectify the Globe and *Hour Index*, and bring the Star to the Eaſt or Weſt part of the Horizon, or to the Brazen Meridian, and the Index will ſhew accordingly the Time of the Star's *Riſing*, *Setting*, or *Culminating*, or of its being on the Meridian.

Thus, *May* the 10th, *Arcturus* will be on the Meridian at about ¼ of an Hour after 10 at Night; *Cor Leonis* will be *Setting* about one in the Morning; and the firſt Star in the Head of *Aries* will be *Riſing* about an Hour after.

PROBLEM XV.

To know, at any Time aſſigned, what Stars are Riſing or Setting; what are on the Meridian, and how high they are above the Horizon; and on what Azimuth or Point of the Compaſs they are; by which means the real Stars in the Heaven may eaſily be known by their proper Names, and rightly diſtinguiſhed one from another.

Rectify the Globe, and *fit the Quadrant of Altitude*, and ſet the Globe, by the Means of the Compaſs, due North and South; then turn the Globe and Hour-Index to the Hour of the Night aſſigned; ſo will the Globe, thus fix'd, repreſent the Face or Appearance of the Heavens for that Time.

Whereby you may readily ſee what Stars are in or near the Horizon; what are on or near the Meridian; which are to the North, or which to the South, &c. And the Quadrant of Altitude being laid over any particular Star, will ſhew its *Altitude* and *Azimuth*, and on what point of the Compaſs it is; whereby any Star may eaſily be known, eſpecially if you have a Quadrant, or any ſuch Inſtrument, to take the Altitude of any real Star ſuppoſed to be known by the Globe, to ſee whether it agree with that Star which is its Repreſentative on the Globe or not.

PROBLEM XVI.

Given the Sun's Place, and any Star's Altitude, to find the Hour of the Night.

Rectify the Globe and *fit the Quadrant*, then move the Globe to and fro till the Quadrant cut the Star in its given Altitude, for then the Hour-Index will ſhew the Hour of the Night: And thus may the Hour of the Night be known by a Star's *Azimuth*, or its *Azimuth* from its *Altitude*.

Example.

May the 10th, the Sun being in the firſt Degree of *Gemini*, I take the Altitude of *Lucida Lyra*, which I find to be 51 Degrees, or I find its *Azimuth* to be two Degrees to the Northward of the Eaſt; then bringing the Quadrant of the Altitude to cut the Star in 51 Degrees of *Altitude*, I find the Hour-Index points at Eleven a Clock at Night; as it would alſo have done had the Star been brought to the *Azimuth* on the Globe.

PROBLEM XVII.

To find the Diſtance between any two Stars.

If the Stars lie both under the ſame Meridian, bring them to the Brazen Meridian, and the Degrees between them there reckoned are their true Diſtance.

Thus *Capella*, or the Star in the Left Shoulder of *Auriga*, and *Rigel*, which is in *Orion*'s Left Thigh, are nearly under the ſame Meridian; and being both brought to the Brazen Meridian of the Globe, their Diſtance there will be found to be 54 Degrees.

If they are both in the Equinoctial, or have both the ſame Declination, *i. e.* are both in the ſame Parallel, then bring them one after another to the Brazen Meridian, and the Degrees of the Equinoctial intercepted between them, when thus brought to the Meridian ſeverally, are their Diſtance.

If the Stars are neither under the ſame Meridian, nor parallel, then either lay the Quadrant of Altitude from one to the other, (if it will reach) and that will ſhew the Diſtance between them in Degrees; or elſe take the Diſtance with Compaſſes, and apply that to the Equinoctial, or to the Meridian.

Which Method of proceeding alſo will ſhew the Diſtance of any two Places on the Terreſtrial Globe in Degrees; and by Multiplication by 70, you will have it in Miles. Wherefore to find how far any Place of the Globe is from another, you need only take the Diſtance between them on the Globe with a pair a pair of Compaſſes; and applying the Compaſſes to the Equator at the beginning of *Aries*, or at the firſt Meridian, you will there find the Degrees; which multiply by 70, and that will turn it into Miles.'

Thus the Diſtance between *London* and *Jamaica* being on the Globe 69 Degrees, I multiply that by 70, and it gives me 4830 Miles; and ſo far is *Jamaica* diſtant *directly* from *London*, or in an Arch of a great Circle.

GLOBULAR *Chart*, a Repreſentation of the Surface, or ſome part of the Surface of the Terraqueous Globe upon a Plane; in which the Parallels of Latitude are Circles nearly Concentrick; the Meridian Curves bending towards the Poles; and the Rhumb-Lines likewiſe Curves.

GLOBULES, are ſuch ſmall Particles of Matter as are of a globular or ſpherical Figure: As the red Particles of the Blood which ſwim in the tranſparent *Serum*, which are eaſily diſcoverable by the Microſcope; and 'tis pleaſant to ſee how theſe Blood-Globules, whenever they come within a due Diſtance, do attract one another, and unite like Spheres of Quickſilver; and by this Means the Blood ſeparates into two Parts; one of which is the Coagulation this Way of the red Parts of it, and the other is the *Serum*. Now the *Serum* conſiſts of a great Number of Corpuſcles or ſmall Particles; (but they are not all ſpherical nor globular, like the red Globules of the Blood) and theſe of various Figures and Magnitudes, and ſwimming in a limpid Fluid. And theſe ſerous Particles don't unite with, nor attract one another as the former did, till ſome Part of the Fluid in which they ſwim hath been evaporated by Heat; but then they do (and form a *Coagulum*) as the Blood Globules did. So that the Power of Attraction is greater in the red Globules, than in the Particles of the *Serum*.

GLOBULUS *Naſi*, is the lower cartilaginous moveable part of the Noſe.

GLOSSOCOMON, [γλωσσόκομον of γλῶσσα and κομέω, Gr. to take Care of,] is a Chyrurgeon's Inſtrument for broken Limbs; ſo called from the Shape of a Merchant's little Caſket, which was formerly carried upon the Back. *Blanchard.*

GLOSSOPETRA, } [of γλῶσσα or γλῶττα a
GLOTTOPETRA, } Tongue, and πέτρα Gr. a Stone,] a kind of Stone in the form of a Tongue, found frequent in the Iſland of *Malta*, and divers other Places. The common People fancy them to be Stones of Serpents petrified: And ſince the Viper in that Iſland bit St. *Paul*'s Hand without doing him any harm, all the Serpents have become as harmleſs: And that the *Gloſſopetræ* are the Tongues of thoſe Serpents that died formerly. But this Imagination is contradicted, in that the *Gloſſopetræ* have nothing of the Figure of a Serpent, and beſides that they are too big.

Naturaliſts ſuppoſe them to be the Tongues of Fiſhes, left upon the Land by the Waters of the Deluge, and ſince petrified. Some take them to be the Teeth of a Sea Dog.

GLOTTIS, [γλῶττα, Gr. the Tongue,] is the Chink of the *Larynx*, which is covered by the *Epiglottis*.

GLUTÆI, [of γλȣ́τος, Gr. the Buttocks,] are ſix Muſcles which move the Buttocks, on each Side three.

GLUTÆUS *Major*, a Muſcle of the Thigh, ſo called from its being the largeſt Muſcle of thoſe which compoſe the Buttocks: It has a large Semi-circular Beginning, forwards meerly tendinous from near two Thirds of the external Parts of the Spine of the *Os Ilium*; backwards its Origination is thick and fleſhy from the poſterior part of the Spine, and hindermoſt part of the *Sacrum* laterally, and the whole *Os Coccygis*; as alſo from a broad Ligament that's extended between the two laſt named Bones and the Tubercle of the *Os Iſchium*; its fleſhy Fibres deſcending diſgregately, in an almoſt Semi-circular manner, become tendinous as they approach the great *Trochanter*, where it's united with its firſt deſcribed tendinous Beginning, deſcending over the external part of the great *Trochanter*, and after being joined with the Tendon of the *Membranoſus*, proceeds to cover and ſtrictly embrace all the external Muſcles of the *Tibia*, like as the external Tendon doth of the *Biceps* of thoſe of the *Cubit*: But the other part of it proceeding from the fleſhy Body of this Muſcle, is largely inſerted to the *Linea Aſpera*, on the back-part of the *Os Femoris*, near four Finger's Breadth below the great *Trochanter*.

The firſt deſcribed tendinous Beginning of this Muſcle doth not only ſerve to ſupport its fleſhy Body, but its Fibres interſecting thoſe of the *Membranoſus*, as they cover all the Muſcles of the *Tibia*, do more adequately include them, whereby they are corroborated in their Action: When this Muſcle acts, it pulls the Thigh directly backwards. *L.*

GLUTÆUS *Medius*, a Muſcle of the Thigh which lies chiefly under the tendinous beginning of the *Glutæus Major*, and ariſing Fleſhy from almoſt the whole external Part of the *Os Ilium*, in its deſcent becomes thicker and fleſhy, and is inſerted by a ſhort ſtrong Tendon to the ſuperior and external Part of the great *Trochanter* in a Semi-circular manner. Mr. *Cowper* thinks this Muſcle is employed to turn the Thigh inwards, though others ſay it ſerves to extend it. *L.*

GLUTÆUS *Minor*, is a Muſcle of the Thigh, which lies totally under the *Glutæus Medius*, it being ſo much leſs than that, as that is than the *Glutæus Major*. It ariſeth Semi-circular, Broad, and Fleſhy from the *Dorſus Ilii*; from hence its fleſhy Fibres deſcend to their partly tendinous and partly fleſhy Inſertion, like the *Medius*, at the ſuperior Part of the Root of the great *Trochanter*.

The Fibres of this running parallel with thoſe of the *Medius*, aſſiſt it in all its Actions: They alſo aſſiſt in rendring the articulation of the Thigh-bone, with the *Coxa*, more ſtable in ſtanding erect. *L.*

GLUTIA [γλȣ́τια, Gr.] are two Prominences of the Brain called *Nates*.

GLUTOS [γλȣ̃τος, Gr.] is the greater *Rotator* (an *Apophyſis*) in the upper part of the Thigh-bone, named *Trochanter*. *Blanchard.*

GLYPHE [γλυφὴ of γλύφω, Gr. to carve or engrave] a general Name given by Architects to any Cavity or Canal, whether round or terminating in an Angle, us'd as an Ornament in any part.

GLYPHICE [γλυφικὴ of γλύφω, Gr.] is a part of Sculpture, being the Art of Cutting, Carving, or Caſting the Images and Reſemblances of natural Things in Metals.

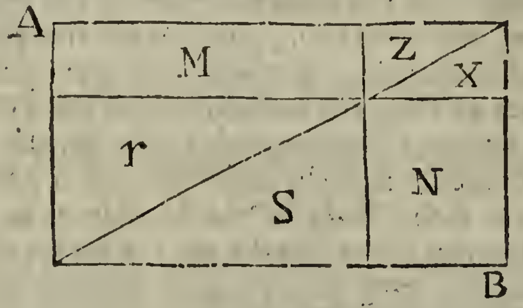
GNOMON [γνώμον, Gr. an Index] in *Dialling*, ſignifies the *Style*, *Pin*, or *Cock* of a Dial, the Shadow whereof pointeth out the Hours.

The *Gnomon* of every *Dial* is ſuppoſed to repreſent the *Axis of the World*; and therefore the two

Ends or Extremities thereof muſt directly anſwer to the *North* and *South Pole*.

GNOMON [in *Aſtronomy*] an Inſtrument or *Apparatus* for meaſuring the Meridian Altitudes of the Sun and Stars. This Inſtrument is, by thoſe who are very converſant in Obſervations, preferr'd to ſmaller Quadrants, as more accurate, more eaſily made, and eaſier apply'd.

GNOMON, in a Parallelogram, is a Figure made of the two Complements, together with either of the Parallelograms about the Diagonal.



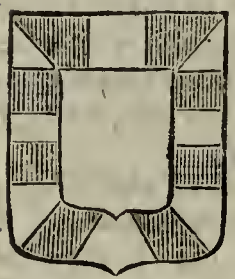
Thus here, in the Parallelogram *AB*, the *Gnomon* is $M + z + x + N$, or $M + r + s + N$.

GNOMONICA, GNOMONICE, [Γνωμονικὴ, Gr.] the Art of Dialling, or the drawing of Sun and Moon Dials on any given Plane.

GNOMONICKS, the ſame with Dialling.

GOARING. The Seamen ſay a Sail is cut *Goaring*, when 'tis cut ſloping by degrees, and is broader at the *Clew* than at the *Earing*, as all *Top-Sails*, and *Top-gallant Sails* are.

To GO *to God*, *To* GO *without Day*, [in *Law*,] are Phraſes us'd to ſignify to be diſmiſs'd the Court, to be acquitted.



GOBONATED, a Term in Heraldry for a Bordure of this Form; which is neither *Checky*, nor *Counter-componed*, but of a different Diviſion from both.

GOLD *Mines*. In *Phil. Tranſ. N.* 58. Dr. *Edw. Brown* gives the following Account of the Gold Mines in *Hungary*. Among the ſeven Mine Towns in *Hungary*, (which are not far from one another, *viz. Chremnitz*, *Schemnitz*, *Newſol*, *Coningsberg*, *Bochantz*, *Libeten*, and *Tiln*) *Chremnitz* is the richeſt in Gold. They have alſo at preſent, *Gold Mines* at *Bochantz* and *Coningsberg*; and they report in that Country, that there hath been formerly a rich *Gold Mine* at *Glaſs-Hitten*, but loſt ſince that *Bethlem Gabor* over-ran thoſe Parts, when the Undertakers ſtopped up the Mine and fled.

They have worked in the *Gold Mine* at *Chremnitz* 900 Years. This Mine is divers *Engliſh* Miles in Length, and about 160 Fathoms Deep. Many Veins of the Ore run to the North, and to the Eaſt. They work alſo towards One, Two, and Three of the Clock, as they ſpeak; for the Miners direct themſelves under Ground by a Compaſs, not of 32 Points (ſuch as is uſed at Sea,) but by one of 24; which they divide, as we do the Hours of the Day, into twice Twelve. Of the Gold Ore, ſome is white, and ſome black, red, or yellow: That with black Spots in white is eſteem'd the beſt, as alſo the Ore which lieth next to the black Veins. This Ore is not rich enough to ſuffer any Proof in ſmall Parcels, like that in other Mines, whereby to know what Proportion of Metal is contain'd in it; but they pound a very great Quantity thereof, and waſh it in a little River, which runs nigh the Town. The whole River being divided, and admitted into divers Cuts, runs over the Ore continually, and ſo waſheth away the Earthy Parts from the Metalline: And from a clear River above the Town, by its running through ſo many Works, and over ſo much pounded Ore, it becomes below the Town a dark-yellow Stream, of the Colour of the Earth of thoſe Hills.

There have been pieces of pure Gold found in the Mine; ſome of which I have ſeen in the *Emperor's Treaſury*, and in the *Elector* of *Saxony's Repoſitory*; one Piece as broad as the Palm of my Hand, and others leſs, and upon a white Stone many Pieces of pure Gold; but theſe are very rare.

The common yellow Earth of the Country near *Chremnitz*, although it be not eſteem'd Ore, affords ſome Gold: And in one Place I ſaw a great part of an Hill digg'd away, which hath been caſt into the Works, waſhed and wrought in the ſame manner as pounded Ore with conſiderable Profit.

Some Paſſages in this Mine, cut through the Rock, and long diſuſed, have grown up again; and I obſerv'd the Sides of ſome, which had been formerly wide enough to carry their Ore through, to approach each other, ſo as we paſſed with difficulty. This happens in moiſt Places. The Paſſages unite not from the Top to the Bottom, but from one Side to another.

There is *Vitriol* in this Mine, white, red, blue, and green; and alſo *Vitriol* Waters. There is a Subſtance found which ſticks to the Gold Ore, of ſmall pointed parts like Needles, called by them *Antimony of Gold*. There are Chryſtals found here, and ſome tinctured yellow.

The Miners will not allow any Quickſilver or Brimſtone to have been found here; yet in the lately mention'd *Antimony of Gold*, there is evidently Sulphur, as I perceiv'd by burning. The Quickſilver Mine mentioned in the Anſwer to *Kercher's Inquiries*, *Mund. Subter.* is an *Hungarian* Mile, or ſeven *Engliſh* Miles diſtant from *Chremnitz*, and is not wrought in at preſent.

There is a *Vitriol Mine* in theſe Hills near the *Gold Mine*; the Earth or Ore of it is reddiſh, and ſometimes greeniſh. This Earth is infuſed in Water, and after three Days, the Water is poured off, and boiled ſeven Days in a Leaden Veſſel, till it comes to a thick granulated whitiſh Subſtance, which is afterwards reduced to a *Calx* in an *Oven*, and ſerveth in the making *Aquafortis*, or the *Separating Water* uſed at *Schemnitz*.

They have divers Ways of taking the Gold out of its Ore; by burning the Ore; by melting; by adding Silver Ore, and other Minerals, Sand, and Lead, as they find the Ore fluid or fix'd.

But without Lead they proceed thus:

They break and pound the Ore in Water, very fine; they waſh it often, and lay it in Powder upon Cloths, and by the gentle oblique deſcending of the Water over it, and their continual ſtirring it, the earthy, clayiſh, and lighter parts, are waſhed away, while the heavier and metalline remain in the Cloths; theſe Cloths are afterwards waſhed clean in ſeveral Tubs, and the Water, after ſome ſettling, poured off from its Sediment; which Sediment is again waſh'd, and ſtirred up in ſeveral Veſſels and Troughs, 'till at length they ſprinkle Quickſilver upon it, and knead it well together for an Hour, and then waſhing it again in a wooden Veſſel, after the ſeparating of much of it which the Quickſilver touches not; by ſtriking this Veſſel againſt their Leg, they bring the Gold and Quickſilver together, in an *Amalgama*, to one Corner of it. From this *Amalgama* they ſtrain as much of the Quickſilver as they can through coarſe Cloths firſt, and then through fine; then they put the Maſs remaining upon a perforated Plate, which they ſet over a deep Pan placed in the Earth, in the Bottom of which Pan they alſo put Quickſilver: This Pan they cover, and lute the Cover well, and then making a Charcoal Fire upon it, they drive down the Quickſilver, yet remaining in the Gold, to the reſt in the Bottom of the Pan; then taking out the Gold, they caſt it into the Fire, that it may become purer.

Concerning *Cranach-Gold*, I cannot learn that there is any ſuch *Gold*, or Place where *Gold* is digg'd in *Hungary*; but in *Germany* I think there is; for *Agricola* mentions ſuch a Place as *Golde-Cranacum*, and another called *Golde-Crona.*

For the exceeding Minuteneſs of the Conſtituent Particles of *Gold*, ſee *Ductility.*

GOLDEN-*Number*: See *Cycle of the Moon.*

To find the Golden-Number.

To the Year add 1, and divide the Sum by 19, the Remainder is the *Golden-Number.*

Example.

To 1701 add 1, the Sum 1702 divide by 19, the Remainder 11 is the *Golden-Number* for that Year.

GOLDEN-*Rule*: See *Rule of Three.*

GOLDEN *Sulphur of Antimony*, is made by boiling the Droſs, ariſing in the making of *Regulus of Antimony*, in a little more than its Weight of common Water, in an Earthen Pot for about half an Hour, and then ſtraining the Liquor, there is Vinegar poured upon it, on which a Reddiſh or Gold Coloured Powder, will precipitate: It muſt be gathered by Filtration and dried; 'tis an Emetick; the Doſe from 2 to 6 Grains.

GOLOPES, [in *Heraldry*,] are Roundles of a Purple Colour.

GOMPHOS, [γόμφος, Gr.] is when the Pupil of the Eye, going beyond a little Skin of the *Tunica Uvea*, is like that Swelling of hard Fleſh in the Corner of the Eye, called *Clavus*. *Blanchard.*

GOMPHOSIS, [γόμφωσις, Gr. or *Conclavatio*,] is when one Bone is faſtened into another like a Nail, as may be ſeen in the Teeth. *Blanchard.*

GONAGRA, [γοναγρα of γόνυ a Knee, and ἄγρα, Gr. Capture,] the Gout in the Knee.

GONORRHÆA, } GONORRHEA, } [γονοῤῥοία of γόνος Seed, and ῥέω, Gr. to flow,] an involuntary Flux, or dripping of the Seed or other Humour by the *Penis*, without Erection or Titillation; and it is of two kinds, *Simple* or *Virulent.*

Simple GONORRHÆA, is one that is not malignant, that proceeds from violent Exerciſe and Straining; the immoderate uſe of hot Foods, and particularly fermented Liquors, as Wine, Beer, *&c.*

A Virulent GONORRHÆA, is one which proceeds from ſome impure Commerce, and is the firſt Stage of the *Venereal Diſeaſe*, the ſame that is commonly call'd a *Clap.*

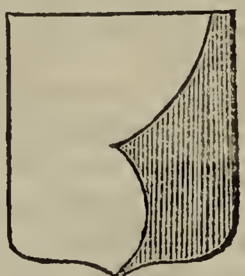
A Simple Gonorrhœa is of two kinds, either *True* or *Spurious.*

A True Simple Gonorrhœa is ſuch, where the Humour diſcharg'd is real *Semen.*

A Simple Spurious Gonorrhœa is when the dripping Humour is not the real *Semen*, but ſome Matter proceeding from the Glands about the *Proſtates.*

GOOD-A-BEARING, or *Good-behaviour*, in Common Law, ſignifies an exact Carriage or Behaviour of a Subject to the King and his Liege-people, whereunto Men upon their evil courſe of Life, or looſe Demeanor, are ſometimes bound: He that is bound to this, is more ſtrictly bound than to the Peace; for the Peace is not broken without an Affray, but this Surety, *de bono geſtu*, may be forfeited by the number of a Man's Company, or by his or their Weapons or Harneſs.

GOOSE-WING: When a Ship ſails before a Wind, or with a Quarter-Wind, and in a freſh Gale, the Seamen ſometimes, to make the more haſte, do *unparel* the Miſſen-yard, and then they launch out both Sail and Yard over the Quarter on the Lee-ſide, fitting Guyes at the further End, to keep the Yards ſteddy with a *Boom*, and this booms out the Miſſen-ſheet; and all this they do to give the Ship the more way, which otherwiſe, with theſe Winds, the Miſſen-ſail could not do, and this Sail ſo fitted is called a *Gooſe-wing*, and ſometimes a *ſtudding Sail.*



GORE, [in *Heraldry*,] is one of the Regular Abatements, which *Guillim* ſays denotes a Coward. It conſiſts of two Arches or Curve Lines, drawn the one from the Siniſter Chief, and the other from the Siniſter Baſe, and meeting in an acute Angle, in the middle of the Feſſe Point; as in the Angle annex'd.

GORGE, *Gula*, or *Neck*, [in *Architecture*,] is the narroweſt part of the *Tuſcan* or *Dorick* Capitals, lying between the *Aſtragal* above the Shaft of the Pillar and the *Annulets.* It is alſo a kind of Concave Moulding, larger, but not ſo deep as a *Scotia*, which ſerves for Compartments, Chambranles, *&c.*

GORGE *of a Chimney*, is that part between the Chambranle and the Crowning of the Mantle; and 'tis of divers Forms, *viz.* ſtrait, perpendicular, in form of a Bell, *&c.*

GORGE, [in *Fortification*,] is the Entrance of the Platform of any Work.

GORGE, in all other Out-Works, is the Interval betwixt their Wings on the Side of the great Ditch: But it ought to be obſerved, that all the *Gorges* are deſtitute of *Parapets*, becauſe if there were any, the Beſiegers having taken Poſſeſſion of a Work, might make uſe thereof, to defend themſelves from the Shot of the Place; ſo that they are only fortified with *Palliſadoes* to prevent a Surprize.

GORGE *of a Baſtion*, is nothing elſe but the prolonging of the *Curtains* from their Angle with *Flank* to the Centre of the *Baſtion* where they meet: But when the *Baſtion* is flat, its *Gorge* is a right Line which terminates the Diſtance comprehended between two Flanks.

GORGE *of the Ravelin*, or of a *Half-Moon*, is the Space contained between the Extremities of the two Faces on the Side of the Place.

GORGED, the Herald's Term for the Bearing of Crown, Coronet, or ſuch like thing about the Neck of a Lion or a Swan, *&c.* for then they ſay the Lion or Cygnet is *Gorged* with a Ducal Coronet, *&c.*

GORGERIN, [in *Architecture*,] is the little Freeze of the *Dorick* Capital, between the *Aſtragal* at the Top of the Shaft of the Column and the *Annulets*.

GOTHICK, [in *Architecture*,] is an Order ſo far different from the ancient Proportions and Ornaments, that its Columns are either too maſſy in a Form of vaſt Pillars, or as ſlender as Poles, having Capitals without any certain Dimenſions, carved with the Leaves of *Brank-Urſin*, *Thiſtles*, *Coleworts*, &c.

GOTHICK *Manner of Building*, was unhappily brought into Uſe, after the Irruption of thoſe barbarous Nations, the *Goths* and *Vandals*, &c. from the North, and the *Moors* and *Arabs*, from the South and Eaſt, into the civiliz'd World. Theſe rude People demoliſh'd what they could of the antient *Greek* and *Roman* Architecture, and inſtead of thoſe admirable and regular Orders and Manner of Building, introduced a licentious and fantaſtical Manner, which, tho' ſometimes adorn'd with expenſive Carvings, and coſtly, tho' lamentable Imagery, is without any of that auguſt Beauty, and juſt Symmetry, which the Fabricks of the Antients entertain us with.

GRACILIS, is one of the Muſcles of the Legs, ſo called from being the moſt ſlender of them: It ariſes ſomewhat broad, partly tendinous and partly fleſhy from the *Os Pubis* internally, between the firſt and ſecond deſcribed Heads of the *Triceps*, and in its ſtrait Deſcent in the Inſide of the Thigh grows narrow, and becomes tendinous a little above the *Sartorius*, and is ſo inſerted (immediately beneath it) to the *Tibia*. It aſſiſteth in bending the Thigh and Leg inwards. *L.*

GRADATION, [in *Architecture*,] is an artificial Diſpoſition of ſeveral Parts, as it were by Steps or Degrees, after the manner of an Amphitheatre; ſo that thoſe placed before do no Diſſervice, but rather Service to thoſe behind.

GRADATION, [in *Chymiſtry*,] a certain ſort of Proceſs us'd of Metals, which conſiſts in exalting or raiſing them to a higher Degree of Purity and Goodneſs, ſo as both to augment their Weight, Colour, Conſiſtence, &c.

GRADATION, [in *Painting*,] is us'd to denote an inſenſible Change of Colour, by the Diminution of the Teints and Shades.

GRADATORY, [in *Architecture*,] a Place where the Aſcent is by Steps, particularly an Aſcent from the Cloyſter to the Choir in ſome Churches.

GRADUATION, [in *Mathematicks*,] the Art of dividing any thing into Degrees, as of a *Quadrant*, *Theodolite*, &c.

GRAIN is us'd for a ſmall Weight in eſtimating divers Subſtances, and is the ſmalleſt Weight us'd in *England*. It is taken from a Grain of Wheat taken out of the middle of the Ear and well dry'd: 24 Grains make a Penny Weight, and 20 Penny Weight an Ounce, and 12 Ounces a Pound *Troy* Weight, which is us'd in weighing Gold, Silver, Bread, &c. Alſo the Grain us'd by Apothecaries, is the ſame that is us'd by the Goldſmiths, tho' the Weights rais'd there-from are different: Thus, 20 Grains, with Apothecaries, make a Scruple ℈, 3 Scruples a Dram ʒ, 8 Drams an Ounce ℥, &c. and 4 Grains make a *Carat*, in weighing Jewels.

GRAMINEOUS *Herbs*, [*Gramineus*, L.] amongſt the Botaniſts, are ſuch as have a long narrow Leaf, and no Foot-ſtalk.

Theſe Biſhop *Wilkins* (in his real Character) ranges into ſuch as are either,

1. *Frumentaceous*, *i. e.* whoſe Seed is uſed by Men for Food, either Bread, Drink, or Broth; ſuch as Wheat, Rye, Barley, &c. Or,

2. Not *Frumentaceous*, more properly called Graſſes, which have an hollow-jointed Stalk not branched, and a ſtamineous Flower: See *Gramina* and *Graſſes*. The *Frumentaceous Herbs* are ſometimes called *Cercoles*.

GRAMMAR, is the Art of Speaking and Writing any Language truly. It takes its Name from the *Greek* Word Γράμμα, which ſignifies a Letter, becauſe it treateth primarily of the Formation of Articulate Sounds, which are repreſented by Letters.

Grammar, is thus very juſtly defined by Mr. *Johnſon*, in his grammatical Commentaries: *That it is the Art of expreſſing the Relations of Things in Conſtruction, with due Accent in Speaking, and Orthography in Writing, according to the Cuſtom of thoſe whoſe Language we learn.*

GRANADO, is a little hollow Globe or Ball of Iron, or other Metal, about two Inches and a half in Diameter, which being filled with fine Powder, is ſet on fire by the means of a ſmall Fuſee faſtened to the Touch-hole; as ſoon as it is kindled, the Caſe flies into many Shatters, much to the Damage of all that ſtand near. Theſe *Granadoes* ſerve to fire cloſe and narrow Paſſages, and are often thrown with the Hand among the Soldiers to diſorder their Ranks, more eſpecially in thoſe Poſts where they ſtand thickeſt; as in *Trenches*, *Redoubts*, *Lodgments*, &c.

GRAND-*Aſſize*: See *Aſſize*.

GRAND-*Cape*: See *Cape* and *Attachment*.

GRAND *Climactericks*: See *Climacterical-Year*.

GRAND *Days*, are thoſe in every Term ſolemnly kept in the Inns of Court and Chancery, *viz.* In *Eaſter* Term, *Aſcenſion Day*; In *Trinity* Term, *St. John Baptiſt's Day*; In *Michaelmas* Term, *All-Saints Day*, (and of late, *All-Souls Day*); and in *Hillary* Term, the Feaſt of the *Purification of our Lady*, commonly called *Candlemas Day*. Theſe are *Dies non Juridici*, no *Court Days*.

GRAND-*Diſtreſs*, is ſo called, becauſe of the Quality and Extent thereof; for thereby the Sheriff is commanded, *Quod diſtringat tenentem, ita quod nec ipſe nec aliquis per ipſum ad eam anum apnat, donec habuerit aliud præceptum, & quod de exitibus eorundum nobis reſpondeat, & quod habeat corpus ejus, &c.*

This Writ lies in two Caſes, either when the Tenant or Defendant is attached, and ſo return'd, and appears not, but makes *Default*; then a *Grand-Diſtreſs* is to be awarded: Or elſe when the Tenant or Defendant hath once appeared, and after makes *Default*, then this Writ lies by the Common Law in lieu of a *Petit-Cape*.

GRAND *Guſto*, is a Term uſed by Painters, to expreſs, that in a Picture there is ſomething very great and extraordinary, to ſurprize, pleaſe, and inſtruct. Where this is found, they ſay the Painter was a Man of the *Grand Guſto*, or *Goût*: And they uſe the Words *Sublime* and *Marvellous*, when they ſpeak of a Picture, in much the ſame Senſe.

GRANIVOROUS, [*Granivorus*, L.] are thoſe Animals that feed upon Corn and other Seed.

GRANT, [in *Law*,] ſignifies a Gift in Writing of ſuch a Thing as cannot aptly be paſſed or conveyed by Word only, as Rents, Reverſions, Services, Advowſons in Groſs, Common in Groſs, Tythes, *&c.* Or made by ſuch Perſons as cannot give but by Deed, as the King and all Bodies Politick: Which difference is often in Speech neglected, and then it is taken generally for every Gift whatſoever, made of any thing by any Perſon; and he that *granteth* is named *Grantor*, and he to whom it is made, the *Grantee*. A Thing is ſaid to lie in *Grant*, which cannot be aſſigned without Deed, 3 *Rep.* 63.

GRANULATION, [in *Chymiſtry*,] ſignifies pouring a melted Metal drop by drop into cold Water, that ſo it may *granulate* or congeal into ſmall Grains. The beſt way is to pour the Metal through an Iron Cullender, or through a new Birchen Broom. *L.*

GRAPHOIDES, a long, ſharp, and ſlender Appendix of the Temple-Bones, ſomewhat bow'd like a Cock's-Spur: Alſo the Muſcle called *Digaſtricus.*

GRAPHOIDES, [of γραφὶς a Pencil, and εἶδος, Gr. Form,] is a Proceſs like the Pen for a Table-book; about the Baſis of the Brain it inclines backward.

GRAPHOMETER, a Surveying Inſtrument, the ſame as a Semi-circle.

GRAPPLINGS, the ſame with *Grapnels.* See that Word.

GRAPNEL, is a kind of Anchor for Boats or Gallies to ride by: They differ from other Anchors, in that they have four Flukes and no Snack, though there are ſome with three Flukes, with which they uſe to *ſweep* for Hawſers or ſmall Cables. In Men of War alſo theſe *Grapnels*, or at leaſt a lighter kind of them, are uſed to be thrown into an Enemy's Ship, in order to catch hold of ſome of her Gratings, Rails, Gunwales, *&c.* this is done in order to boarding of her.

GRAS-*Hearth*, was formerly the Cuſtomary Service for all the inferior Tenants to bring their Plows, and do one Day's Work for the Lord, within four Days after *Michaelmas.*

GRATICULATION, the dividing a Draught or Deſign into Squares, in order to reduce it.

GRATINGS, in a Ship, are ſmall Ledges of ſawed Plank, framed one into another like a Lattice or Priſon-grate, lying on the Upper-Deck between the Main-Maſt and Fore-maſt, ſerving for a Defence in a Cloſe Fight; and alſo for the Coolneſs, Light and Contrivance of the Ship's Company.

There is alſo another *Grating* in the Head of a Ship, where the Neceſſary-Houſe ſtands.

GRAVE-*Accent*, [in *Grammar*,] ſhews when the Voice is to be depreſs'd, and is expreſs'd thus, [`].

GRAVEDO, the ſame with *Corryza.*

GRAVELLED-*Aſhes*, are the Lees of Wine dried and burn'd to Aſhes: So that they are a kind of Calcined Tartar.

GRAVING *of a Ship*, is bringing her firſt a-ground, and then burning off (with Reeds, Broom, *&c.*) all the Filth and Foulneſs that ſticks to her Sides without-board, in order to *pay* her anew.

GRAVITAS *Acceleratrix*: See *Vis Centripeta.*

GRAVITY, or as it may be called, the *Vis Centripeta*, is that Quality by which all heavy Bodies tend towards the Centre of the Earth, accelerating the Motion as they come nearer towards it. And this admirable and univerſal Law of Nature is that which (generally ſpeaking) keeps all Bodies in thoſe Places and Stations which they are deſigned for.

About the Cauſe of this great and Catholick Affection of Matter, there have been various Sentiments.

1. *Ariſtotle* will have all Earthy Bodies, by a Natural Inclination, to tend towards the Centre of the Earth, as to their proper Place, *Sub Concava Lunæ*: But it hath been proved over and over, that there is no ſuch thing as *Poſitive* or *Abſolute Gravity* or *Levity.*

2. *Copernicus* aſſerts *Gravity* to be an innate Principle in all the Parts of Matter, when they are by any Means ſeparated from their Wholes, to reduce themſelves thither again the neareſt Way or in Right Lines. But this is not to aſſign any Phyſical Cauſe of this great Effect, but only to ſay Bodies deſcend, becauſe they are heavy, or becauſe they deſcend.

They alſo that explain *Gravity* by *Univerſal Attraction*, do only give us another Word, but no Idea of the Cauſe of *Gravity.*

3. *Gaſſendus* and *Kepler*, and many others, define *Gravity* to be a Motion impreſſed on all Bodies by a certain magnetick Attraction of the Earth or Globe, to which any Body deſcends.

Theſe will have the Earth to be one great *Magnet* or *Loadſtone*, continually ſending out magnetical *Effluvia*, which lay hold on all Bodies, and draw them towards the Earth. See *Gilbert* and *Kircher de Magnete.*

4. *Des Cartes* ſuppoſes the Particles of his Celeſtial Matter, by being reflected from the Surface of the Earth, and conſequently aſcending up again, from thence to drive down into their Places the Terreſtrial Bodies which they find above them, *Sect.* 20, 21, 22, 23, of his *Principia Philoſoph.*

But 'tis very difficult to conceive, and, I think, implies a kind of Contradiction, that Bodies ſhould be forced downwards by a continual Impulſe of other Matter tending upwards, and acting upon all Parts uniformly and equally.

The ingenious Mathematician Mr. *Keil* of *Baliol-College*, *Oxon*, hath alſo ſufficiently overthrown this *Hypotheſis* in the Preface to his *Introductio ad Veram Phyſicam.*

5. *Voſſius* and ſome others, will needs have the diurnal Motion of the Earth round its Axis to be the Cauſe of the Deſcent of heavy Bodies: Whereas 'tis demonſtrable, from Experiment and the Doctrine of the Laws of Motion, That the Reverſe of *Gravity* would thence enſue: For all Bodies moving circularly, do always endeavour to recede *ab Axe Motus*; and all looſe Bodies would then be caſt off from the Earth in a Tangent to the Parallel Latitude of any Place.

6. Others miſtaking the Effect for the Cauſe, will have the Preſſure of the Atmoſphere to occaſion *Gravity*, or the Deſcent of heavy Bodies: But 'tis plain by Experiments made *in Vacuo*, That the Atmoſphere, like all other Fluids, doth hinder the Deſcent of heavy Bodies, rather than further them or cauſe them; for a Feather *in Vacuo* will deſcend as faſt as a Bullet or Stone in the open Air.

7. The Learned Dr. *Hook*, in his *Micrographia*, *P.* 22. ſeems to think, that by ſuppoſing our Globe of Earth, Air, and Water, environ'd round with a Fluid very ſubtle and heterogeneous to them all, and which can freely pervade the Pores, not only of Glaſs, but even of the cloſeſt Metals; the En-

deavour of this Fluid to detrude all Earthly Bodies from it, may, by that and ſome other Properties, make all Bodies move towards the Centre of the Earth: And he ſaith he can prove by many Experiments, that there is ſuch a Fluid. But this Opinion appears to be defective on the ſame Account that the *Carteſian* is: Which ſee.

8. The Learned Mathematician Capt. *Edmund Halley*, owns *Gravity* to be an Effect unſolvable by any Philoſophical *Hypotheſis*; and Modeſtly and *Religiouſly* reſolves it into the immediate Will of our All-wiſe Creator, who by appointing this Law throughout all the material World, keeps all Bodies in their proper Places and Stations, which without it would ſoon fall to pieces and be utterly deſtroyed. *Philoſoph. Tranſact. N.* 197.

Sir *Iſaac Newton*, *Book* 2. *Prop.* 19. *Corol.* 5. obſerves very well, That of all Bodies conſidered within the Confines of any Fluid, there is a twofold *Gravity*, the one *True* and *Abſolute*, the other *Apparent*, and *Vulgar*, and *Comparative*.

Abſolute Gravity, is the *whole Force* by which any Body tends downwards; but the *Relative* or *Vulgar* is the Exceſs of *Gravity* in any Body above the ſpecifick *Gravity* of the Fluid, whereby it tends downwards more than the ambient Fluid doth.

In reference to *Abſolute Gravity*, the Parts of all Fluids and all Bodies do really gravitate in their proper Places, and therefore by their joint Weights do make the Weight of the Whole: For every heavy Whole is an heavy Body, as we find by Experience in Veſſels filled with all Kinds of Liquors; and the Weight of any Whole is equal to, becauſe compounded of, the Weight of all its Parts.

The latter Kind of *Gravity* is ſuch, that in reference to it, Bodies do not gravitate in their Places, or rather do not, when compared one with another, *pre-gravitate*; but by hindring one another in their mutual Endeavour to deſcend, do remain in their proper Places all one as if they were not heavy at all. Thoſe Things which do not pre-gravitate in the Air, Water, *&c.* the Vulgar take to have no *Gravity*; and only judge thoſe to be heavy Bodies which they ſee pre-gravitate or deſcend, becauſe they cannot be ſupported by the ordinary Gravitation of the Fluid, or by its Preſſure all manner of ways.

So that the Notion of Weight among the Vulgar, is only the Exceſs of any Bodies Weight above that of Air: And conſequently they account thoſe things to be *Light*, which being leſs heavy than Air, are ſupported by it, or buoyed up in it.

Whereas theſe *Comparatively* light Bodies are not ſo *really*, ſince *in Vacuo* it hath been found by Experiment, that they deſcend as faſt as other heavy Bodies do in the Air, (Vid. *Mr.* Boyles's *Experiments of his Air Pump.*)

The Properties of Gravity are very well enumerated by Capt. Halley, *in* Numb. 179. *of* Philoſophical Tranſactions.

1. That by it all Bodies deſcend towards a Point, which either is, or is very near to the centre of Magnitude of the Earth and Sea; about which the Sea forms itſelf into a ſpherical Surface, and the prominences of the Land, conſidering the Bulk of the Whole, differ but inſenſibly therefrom.

2. That this Point or Centre is fixed within the Earth, or at leaſt has been ſo ever ſince we have any authentick Hiſtory: For a Conſequence of its Shifting, tho' never ſo little, would be the overflowing of the Low-Lands on that Side the Globe towards which it approached.

And this he thinks would well account for the Univerſal Deluge, To have the centre of Gravitation to be removed for a time towards the middle or the then inhabited World.

And he ſaith, That a change of its Place but the two thouſandth Part of the Radius of our Earth, would be ſufficient to lay the tops of the higheſt Hills under Water.

3. That in all Places equi-diſtant from the centre of the Earth, the Force of *Gravity* is nearly equal.

But indeed all Places on the Earth's Surface are not at equal Diſtance from the Centre; becauſe, as Sir *Iſaac Newton* hath proved, the Equatorial Parts are ſomething higher than the Polar Parts; the Difference between the Earth's Diameter and Axis being about 34 *Engliſh* Miles, which hath been confirmed by the Neceſſity of making a Pendulum ſhorter (in thoſe Places) before they will ſwing Seconds.

4. *Gravity* equally affects all Bodies, without regard either to their *Bulk*, *Figure*, or *Matter:* So that abſtracting from the Reſiſtence of the Medium, the moſt *Compact* and *Looſe*, the *Greateſt* and *Smalleſt* Bodies would deſcend equal Spaces in equal Times, as appears from the quick Deſcent of very light Bodies in the exhauſted Receiver. Whence a very great Difference may be obſerved betwixt *Gravity* and *Magnetiſm*; the latter affecting only Iron, and that towards its Poles; the former all Bodies alike in ever Part.

Hence alſo may be concluded there is no ſuch Thing as poſitive Levity, thoſe Things which appear light being only comparatively ſo. And whereas ſeveral Things riſe and ſwim in Fluids, 'tis only becauſe they are not, bulk for bulk, ſo heavy as thoſe Fluids: Nor is there any Reaſon why *Cork*, for Inſtance, ſhould be ſaid to be light, becauſe it ſwims on *Water*, any more than *Iron*, becauſe it will ſwim on *Mercury*.

5. That this Power increaſes as you deſcend, and decreaſes as you aſcend from the Centre of the Earth; and that in Proportion of the Squares of the Diſtances therefrom reciprocally: So, as for Inſtance, at a double Diſtance to have but a Quarter of the Force, *&c.* which is highly agreeable to Reaſon, becauſe the gravitating or attracting Power muſt needs be exerted more vigorouſly in a ſmall Sphere, and more feebly in a greater, in Proportion as it is contracted or expanded. Wherefore ſeeing the Surfaces of Spheres are to one another, as the Squares of their *Radij*, their Power at ſeveral Diſtances will be as the Squares of thoſe Diſtances reciprocally; and then its whole Action upon each ſpherical Surface, be it great or ſmall, will be always equal.

Mr. *Huygens*, in the laſt Propoſition of his Fourth Part of his Book *de Horologio Oſcillatorio*, ſhews by Experiments moſt accurately made, That *Gravity* is that Force by which a Body placed any where near the Surface of the Earth, is impelled towards the Centre after the Rate of $15\frac{1}{12}$ of *Paris* Feet in a Second of Time.

The very Learned and Ingenious Capt. *Halley*, in his Diſcourſe about the Cauſe of Springs, in *Philoſ. Tranſact. N.* 192. ſeems to think, That there may be ſome Matter, which may have a *Conatus* directly contrary to that of *Gravity*; as is, ſaith he, the Caſe in Vegetation, where the Sprouts tend directly upwards, or againſt the Perpendicular.

GRAVITY. It is now agreed by all Philoſophers that all Circum-terreſtrial Bodies gravitate towards the Earth. That no Bodies really light are to be found, is now confirmed by manifold Experience: That which is relative Levity, is not true Levity, but apparent only; and ariſes from the preponderating Gravity of the contiguous Bodies.

Moreover, as all Bodies gravitate towards the Earth, ſo doth the Earth again towards Bodies: That the Action of *Gravity* is mutual, and equal on both Sides, is thus proved: Let the Maſs of the Earth be diſtinguiſhed into any two Parts whatever, either equal, or any how unequal; now if the Weights of the Parts towards each other were not mutually equal, the leſſer Weight would give way to the greater, and the two Parts joined together would move on *ad infinitum*, in a right Line towards that Part to which the greater Weight tends; altogether againſt Experience. Therefore we muſt ſay that the Weights of the Parts are conſtituted *in Equilibrio*, that is, that the Action of *Gravity* is mutnal and equal on both ſides.

The Weights of Bodies, at equal Diſtances from the Centre of the Earth, are as the Quantities of Matter in the Bodies. This is collected from the equal acceleration of all Bodies that fall from a State of Reſt by the Force of their Weights; for the Forces by which unequal Bodies are equally accelerated, muſt be proportional to the Quantities of the Matter to be moved. Now that all Bodies are in falling equally accelerated, appears from hence, that when the Reſiſtance of the Air is taken away, as it is under an exhauſted Receiver, Bodies falling deſcribe equal Spaces in equal Times; and this is yet more accurately proved, by the Experiments of Pendulums.

The attractive Forces of Bodies at equal Diſtances, are as the Quantities of Matter in the Bodies: For ſince Bodies gravitate towards the Earth, and the Earth again towards Bodies, with equal Moments, the Weight of the Earth towards every Body, or the Force with which the Body attracts the Earth, will be equal to the Weight of the ſame Body towards the Earth. But this Weight was ſhewn to be as the Quantity of Matter in the Body; and therefore the Force with which every Body attracts the Earth, or the abſolute Force of the Body, will be as the ſame Quantity of Matter.

Therefore the attractive Force of the entire Bodies ariſes from, and is compounded of, the attractive Forces of the Parts; becauſe, as was juſt ſhewn, if the bulk of the Matter be augmented or diminiſhed, we muſt therefore conclude that the Action of the Earth is compounded of the united Actions of its Parts; and therefore that all Terreſtrial Bodies muſt attract each other mutually, with abſolute Forces that are as the Matter attracting. This is the Nature of *Gravity* upon Earth; let us now ſee what it is in the Heavens. That every Body perſeveres in its State either of Reſt, or of moving uniformly in a right Line, unleſs in ſo far as it is compelled to change that State by Force impreſſed, is a Law of Nature univerſally received by all Philoſophers. But from thence it follows, that Bodies which move in Curve Lines, and are therefore continually off from the right Lines that are Tangents to their Orbits, are by ſome continued Force retained in thoſe curvilinear Paths. Since then the Planets move in curvilinear Orbits, there muſt be ſome Force operating, by whoſe repeated Actions they are perpetually made to deflect from the Tangents.

Now it is collected by mathematical Reaſoning, and evidently demonſtrated, that all Bodies that move in any curve Line deſcribed in a Plane, and which, by a Radius drawn to any Point, whether Quieſcent, or any how moved, deſcribe Areas about that Point proportional to the Times, are urged by Forces directed towards that Point: This therefore muſt be granted. Since then all Aſtronomers agree that the primary Planets deſcribe about the Sun, and the ſecondary about the primary Areas proportional to the Times, it follows, that the Forces by which they are perpetually turned aſide from the rectilinear Tangents, and made to revolve in curvilinear Orbits, are directed towards the Bodies that are ſituate in the centres of the Orbits. This Force may therefore not improperly be called Centripetal, in reſpect of the revolving Body, and in reſpect of the central Body attractive, whatever Cauſe it may be imagined to ariſe from.

But beſides, theſe Things muſt be alſo granted, as being mathematically demonſtrated, if ſeveral Bodies revolve with an equal Motion in concentrick Circles, and the Squares of the periodick Times are as the Cubes of the Diſtances from the common Centre; the centripetal Forces will be reciprocally as the Squares of the Diſtances. Or, if Bodies revolve in Orbits that are very near to Circles, and the Apſides of the Orbits reſt, the centripetal Forces of the revolving Bodies will be reciprocally as the Squares of the Diſtances. That both theſe Caſes hold in the Planets, all Aſtronomers conſent. Therefore the centripetal Forces of all the Planets are reciprocally as the Squares of the Diſtances from the Centres of their Orbits. If any ſhould object, that the Apſides of the Planets, and eſpecially of the Moon, are not perfectly at Reſt, but are carried with a ſlow kind of Motion *in Conſequentia*; one may give this Anſwer, That though we ſhould grant this very ſlow Motion to ariſe from hence, that the Proportion of the centripetal Force is a little different from the duplicate, yet that we are able to compute mathematically the Quantity of that Aberration, and find it perfectly inſenſible; for the Ratio of the lunar centripetal Force it ſelf, which muſt be the moſt irregular of them all, will be indeed a little greater than the Duplicate, but will be near ſixty times nearer to that than it is to the Triplicate.

The Theory of theſe Bodies was altogether unknown to Aſtronomers, till in our own Times our excellent Author moſt happily diſcovered it, and demonſtrated the Truth of it by moſt certain Obſervations: So that it is now apparent that the Comets move in Conick Sections, having their *Foci* in the Sun's Centre, and by *Radii* drawn to the Sun deſcribe *Areas* proportional to the times. But from theſe *Phænomena* it is manifeſt, and mathematically demonſtrated, that thoſe Forces by which the Comets are retained in their Orbits, reſpect the Sun, and are reciprocally proportioned to the Squares of the Diſtances from its

Centre: Therefore the Comets gravitate towards the Sun, and therefore the attractive Force of the Sun not only acts on the Bodies of the Planets, placed at given Diſtances, and very nearly in the ſame Plane, but reaches alſo to the Comets in the moſt different Parts of the Heavens, and at the moſt different Diſtances. This therefore is the Nature of gravitating Bodies, to propagate their Force at all Diſtances to all other gravitating Bodies; but from thence it follows, that all the Planets and Comets attract each other mutually, and gravitate mutually towards each other, which is alſo confirmed by the Perturbation of *Jupiter* and *Saturn*, obſerved by Aſtronomers; which is cauſed by the mutual Actions of theſe two Planets upon each other; as alſo from that very ſlow Motion of the Apſides, above taken notice of, and which ariſes from a like Cauſe.

We have now proceeded ſo far as to ſhew that it muſt be acknowledged, that the Sun and the Earth, and all the heavenly Bodies attending the Sun, attract each other mutually: Therefore all the leaſt Particles of Matter in every one muſt have their ſeveral attractive Forces, whoſe Effect is as their Quantity of Matter, as was ſhewn above of the Terreſtrial Particles. At different Diſtances theſe Forces will be alſo in the duplicate Ratio of the Diſtances reciprocally; for it is mathematically demonſtrated, that Particles attracting according to this Law, will compoſe Globes attracting according to the ſame Law.

Who doubts, if *Gravity* be the Cauſe of the Deſcent of a Stone in *Europe*, but that it is alſo the Cauſe of the ſame Deſcent in *America?* If there is a mutual Gravitation between a Stone and the Earth in *Europe*, who will deny the ſame to be mutual in *America?* If in *Europe*, the attractive Force of a Stone and the Earth is compounded of the attractive Forces of the Parts; who will deny the like Compoſition in *America?* If in *Europe*, the Attraction of the Earth be propagated to all kinds of Bodies, and to all Diſtances; why may it not as well be propagated in like manner in *America?* All Philoſophy is founded on this Rule; for if that be taken away, we can affirm nothing of Univerſals. The Conſtitution of particular Things is known by Obſervations and Experiments; and when that is done, it is by this Rule that we judge univerſally of the Nature of ſuch Things in general.

Since then all Bodies, whether upon Earth or in the Heavens, are heavy, ſo far as we can make any Experiments or Obſervations concerning them; we muſt certainly allow that Gravity is found in all Bodies univerſally. And, in like manner, as we ought not to ſuppoſe that any Bodies can be otherwiſe than extended, moveable or impenetrable; ſo we ought not to conceive that any Bodies can be otherwiſe than heavy. The Extention, Mobility, and Impenetrability of Bodies become known to us only by Experiments; and in the very ſame manner their Gravity becomes known to us: All Bodies we can make any Obſervations upon, are extended, moveable, and impenetrable, and thence we conclude all Bodies, and thoſe we have no Obſervations concerning, to be extended and moveable, and impenetrable; ſo all Bodies we can make Obſervations on, we find to be heavy, and thence we conclude all Bodies, and thoſe we have no Obſervations of, to be heavy alſo. If any one ſhould ſay that the Bodies of the fixed Stars are not heavy becauſe their Gravity is not yet obſerved; they may ſay, for the ſame reaſon, that they are neither extended, nor moveable, nor impenetrable, becauſe theſe Affections of the fixed Stars, are not yet obſerved: In ſhort, either Gravity muſt have a Place among the primary Qualities of all Bodies, or Extenſion, Mobility, and Impenetrability, muſt not. And if the Nature of Things is not rightly explained by the Gravity of Bodies, it will not be rightly explained by their Extenſion, Mobility, and Impenetrability.

GRAVITY. Dr. *Gregory*, in the Preface to his Excellent Aſtronomy, ſhews, that the antient Aſtronomers knew that the Heavenly Bodies gravitated towards one another, and were kept in their Orbits by the Force of *Gravity*. And that when *Democritus*, *Metrodorus*, and *Diogenes*, and afterwards *Anaxagoras*, *Archelaus*, and *Euripides*, maintain'd the Sun and Stars to be great Globes of Stone or Metal heated red hot; they meant by it, that they were heavy Bodies of ſuch a Denſity, and heated to ſuch a Degree, as to enable them to retain their Fire and Heat for the Purpoſes they were deſigned.

Anaximenes ſaid, the fixed Stars were of a fiery Nature, but had Bodies of an earthy Nature moving round them, which we can't ſee as we can them. And this Opinion he had from *Anaximander*, and he from *Thales Mileſius*, who was the firſt of the *Ionick* Sect of Philoſophers; among whom this was a received Notion. It got alſo into the *Italian* Philoſophy; for thoſe of that Sect maintain'd each Star to be a World, and to have Earths or Planets moving round it, in the infinite *Mundane* Space; and in particular, that the Moon was an Earth like ours, and inhabited by ſome fine Sorts of living Creatures.

In the *Leipſick Acts* of *May*, 1690. there is a Diſcourſe about the Cauſe of *Gravity*, by Mr. *Leibnitz*; together with a Defence of his Opinion of the *true Laws of Nature* againſt the *Carteſians*.

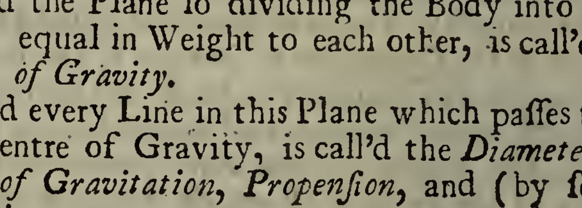
GRAVITY, its *Centre*, is a Point in every heavy Body, through which any Plane whatever being drawn, will divide the Body into two Parts of equal Weight.

And the Plane ſo dividing the Body into two Parts, equal in Weight to each other, is call'd the *Plane of Gravity*.

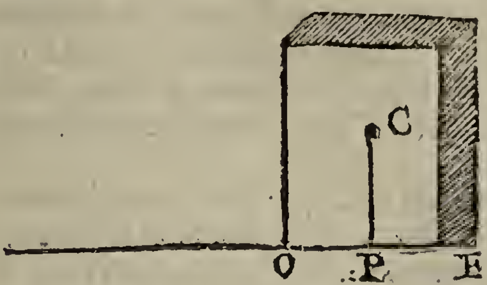
And every Line in this Plane which paſſes thro' the Centre of Gravity, is call'd the *Diameter*, or *Line of Gravitation*, *Propenſion*, and (by ſome) *Innixion*.

The Line of Direction of Gravity, or *Line of Gravity*, is perpendicular from the Centre of Gravity to the Horizon.

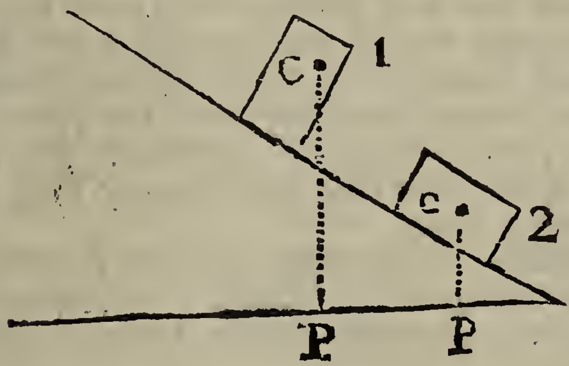
If a Body, being placed upon an Horizontal Plane, have its *Line of Gravity* *CP* falling without its Baſe *O E*; then that Body muſt fall down, and will fall on that Side where the Perpendicular *CP* falls.



But if that Line *CP* falls any where within *O E*, the Baſe or Foot on which the Body ſtands, the Body will reſt there without Danger of falling.

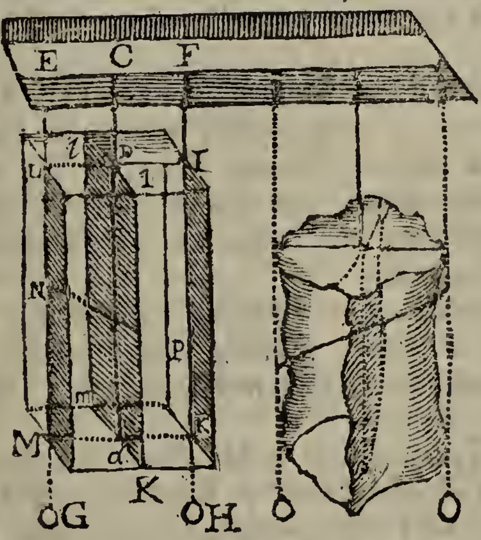


And if a Body be placed on an inclined Plane, and *C P* the Line of Gravity, as in N. 1. falls without the Baſe, it will tumble over; but when it falls within, as in N. 2. it will only ſlide down.

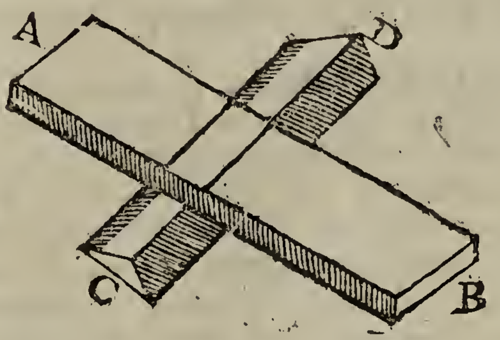


Of the mathematical Way of finding Centres of Gravity: See *Centres of Gravity.*

I ſhall here, from *Sturmius*, give you a good mechanical or practical Way for finding the Centre of Gravity of regular or irregular Solids; by which alſo the Plane of Gravity, and the Diameter of Gravity, may be determined. Apply to the Solid ſuſpended by a Rope, as *CD*, on both Sides of it, the Perpendiculars *E G*, and *F H*, ſo that they may touch in the Lines *I K*, *L M*, which ſhould be mark'd out with Chalk, *&c.* and then be joined above and below by the tranſverſe Perpendiculars *I L*, *K M*, ſo that one of the Planes of Gravity, *I K*, *M L*, may be gained: Alſo having turned the Solid about, find out, after the ſame manner, another ſuch Plane of Gravity, *l i*, *k m*, which will cut the former above in *D*, and below in *d*; and then the Diameter of Gravity *D d* will be had. Then hang the Solid tranſverſly, and the ſame Way find another Diameter of Gravity *N P*, which will cut the former in *O*, the Centre of *Gravity* ſought.



And in ſome Caſes, there may be yet uſed a more Compendious Way; *viz.* Lay the given Solid *A B* on the fine Edge *CD*, of any *Hypomochlion*, turning and moving it about 'till it will reſt there in *Equilibrio*; then will that Plane, in the Body or Solid which anſwers perpendicularly to the Edge of the *Hypomochlion*, be one of the *Planes of Gravity*: Then find out *ſuch another*, by poiſing the Solid another Way oblique to the former, ſo will their common Section be one of the Diameters of Gravity. Laſtly, roll the Solid into another Poſition, and then repeat the former Way of finding another Plane and Diameter of Gravity; ſo ſhall the Interſection of this Diameter of Gravity with the former be the *Centre of Gravity* ſought.



GRAVITY, [in *Hydroſtaticks*,] is the Laws of Bodies gravitating in Fluids; and is either *Abſolute* or *Specifick.*

Abſolute GRAVITY, is the whole Force wherewith the Body tends downwards, call'd *True Gravity.*

Specifick GRAVITY, is the Exceſs of Gravity in any Body, above that of an equal Quantity or Bulk of another; called alſo, *Relative*, *Comparative*, and *Apparent Gravity.*

GRAVITY, [in *Muſick*,] is an Affection of Sounds whereby it becomes denominated *Grave*, *Low*, or *Flat.*

GREAT *Bear:* See *Urſa Major.*

GREAT *Circle-Sailing*, is conducting a Ship (if it be poſſible) in the Arch of a great Circle, which paſſes thro' the *Zenith* of the two Places from whence and to which ſhe is bound. But this from Method is not practicable at Sea, tho' the nearer a Ship can keep to it, the better. See Sir *Jonas Moor*'s *Navigation.*

GREAT *Circles of the Globe or Sphere*, are thoſe whoſe Plane paſſing thro' the Centre of the Sphere, divides it into two equal Parts or Hemiſpheres; of which there are Six drawn on the Globe, *viz.* the *Meridian*, *Horizon*, *Equator*, *Ecliptick*, and the two *Colures:* Which ſee.

GREE, from the *French* Word *Gre*, ſignifies in our Law, *Contentment* or *Satisfaction.* Thus in 2 *R.* II. *c.* 15. to make *Gree* to the Parties, is to give them Contentment ot Satisfaction for an Offence done to them. So in 25 *E.* III. *c.* 19. 'Tis appointed that Judgment ſhall be put in Diſpenſe, 'till *Gree* be made to the King of his Debt. Hence *Agree*, *Agreement*, &c.

GREEK *Orders*, [in *Architecture*,] are the *Dorick*, *Ionick*, and *Corinthian*, in Contradiſtinction to the *Roman*, which are the *Tuſcan*, and *Compoſite.*

GREEN-*Cloth*, or *Counting-Houſe of the King's Houſhold*, is ſo called, becauſe the Table ſtands always covered with a *Green Cloth:* Here ſit the Lord-Steward, Treaſurer of the King's Houſe, Comptroller, Maſter of the Houſhold, Cofferer, two Clerks of the *Green-Cloth*, and two Clerks Comptrollers, for Daily taking the Accounts of all Expences of the Houſhold, making Proviſions and ordering Payment for the ſame, for the good Government of the King's Servants, and paying the Wages of thoſe below Stairs.

GREEN-*Wax*, [in *Law*,] ſignifies the Eſtreats of Fines, Iſſues, and Amerciaments in the Exchequer, under the Seal of that Court made in *Green Wax*, to be levy'd in the County: See *Foreign Apposer*.

GREGARIOUS *Birds*, are ſuch as do not live ſolitarily, but aſſociate in Flights or Coveys, a great many together in Company.

GREGORIAN *Calendar* ſhews the new and full Moon with the Times of *Eaſter*, and the moveable Feaſts that depend on it, by means of Epacts diſpos'd thro' the ſeveral Months of the *Gregorean* Year; and is different from the *Julian* both in the Form of the Year, and in that it uſes Epacts inſtead of Golden Numbers. See *Epact*, and *Golden Number*.

GREGORIAN *Epocha*, is the *Epocha* or Time whence the *Gregorian* Calendar or Computation took Place. See *Epocha*.

GREGORIAN *Year*, the *New Account*, or *New Stile*, inſtituted upon the Reformation of the Calendar by Pope *Gregory* XIII. (from whom it takes the Name) in the Year 1582; whereby ten Days being taken out of the Month of *October*, the Days of their Months go always ten Days before ours: As for Inſtance, their Eleventh is our Firſt Day: Which *New Stile* or *Account*, is uſed in moſt Parts beyond the Seas; and is called, from Pope *Gregory*, the *Gregorian Account*.

GRENADO: See *Grenado-Shell.*

GREUT, is the Miners Word for the Earthy Part of what they dig up, and which hath no Mine or Oar in it, but is peculiar to each particular *Load*, *i. e.* ſuch a *Load* hath ſuch a coloured *Greut*. The common Earth, which is the looſe Mold above the Shelf, in which find the *Shoad*, they call *Deads*.

GRIPE *of a Ship*, is the *Compaſs* or *Sharpneſs* of her *Stem* under Water, and chiefly towards the Bottom of the *Stem*: And the Deſign of ſhaping her ſo, is to make her *gripe* the more, or keep a good Wind; for which end ſometimes a falſe Stem is put on upon the true one.

GRIPE alſo is the Sea Phraſe for a Ship's being apt to run her Head or Noſe too much into the Wind, for then they ſay *She Gripes*. And there are two Cauſes of this Effect; either over-loading a Ship a-head, the Weight of which preſſes her Head ſo down, that it is not apt to fall off from the Wind; or elſe the *Staying* or *Setting* her Maſts too much aft, which will always be a Fault in a ſhort Ship that draws much Water, and will cauſe her to be continually running into the Wind: But in *Floaty Ships*, if the Maſts be not ſtayed very far aft, they will never keep a good Wind.

GROMETS, [in a *Ship*,] are ſmall Rings faſtened to the upper Side of the Yard of a Ship, by Staples, to tie unto it, or to faſten the *Laſkets*.

GROOVE, is the Shaft or Paſſage into the Lead Mines, and by which they draw up their Oar.

GROSSE. Formerly a Villain *in Groſs*, was ſuch a ſervile Perſon as was not appendant or annex'd to the Land or Mannor, and to go along with the Tenure as an Appurtenance of it; but was, like the other Perſonal Goods and Chattles of his Lord, at his Lord's free Pleaſure and Diſpoſal. And thus *Advouſon in Groſs*, is diſtinguiſh'd from *Advouſon Appendant*.

GROTESK *Work*, is a Work or Compoſition in Painting and Sculpture, in the groteſque Manner or Taſte; conſiſting either of Things which are merely imaginary, and have no Exiſtence in Nature, or of Things which are turned or diſtorted out of the way of Nature, ſo as to raiſe Surprize and Ridicule. The ſame that is ſometimes call'd *Antique*.

GROTESQUES, GROTESKS, [in *Architecture*,] little fanciful Ornaments of Animals, intermixt with Foliages, Fruits, *&c.*

GROUND, [in *Painting*,] is the Surface upon which the Figures and other Objects are drawn, rais'd, or repreſented; or it is properly ſuch Parts of a Piece which have nothing repreſented on them.

GROUND *Plates*, [in *Architecture*,] are the outermoſt Pieces of Timber lying on or near the Ground, and framed into one another with Mortiſes and Tennons: In theſe alſo are Mortiſes made to receive the Tennons of the Joiſts, the Summer, and Girders; and ſometimes the Trimmers for the Stair-Caſe and Chimney-Way, and the Binding Joiſts.

GROUND *Tackle*, is the Sea Term for a Ship's Anchor, Cables, *&c.* in general; or whatever is neceſſary to make her ride ſafe at Anchor in proper Ground.

GROUND *Timbers*, in a *Ship*, are thoſe Timbers which lie on her Keel, and are faſtened to it with Bolts through the Keelſon. They are ſo called, becauſe the Ship lies at reſt upon them when ſhe is a-ground.

GROUNDING *of a Ship*, is bringing of her on Ground to be trimmed, made clean, ſcrubbed, or have ſome Leak ſtopp'd in her.

GROUPS, with regard to the *Deſign*, are Combinations of divers Figures which have relation to each other, either on Account of the Action, or of their Proximity, or the Effect they have.

GROUPS, with regard to the *Clairo obſcuro*, are Bodies of Figures wherein the Lights or Shadows are diffus'd in ſuch a manner, as that they ſtrike the Eye together, and lead it naturally to conſider them in one View.

GROUP *of Columns*, [in *Architecture*,] is three or four Columns joined together on the ſame Pedeſtal.

GROUP [in *Muſick*,] is one of the kinds of Diminutions of long Notes, which in the working forms a ſort of Group, Knot, Buſh, or the like. It conſiſts uſually of four Crotchets, Quavers or Semiquavers, tied together, at the Diſcretion of the Compoſer.

GRUME, [in *Phyſick*,] a Particle of Blood, Milk, or other Fluid, coagulated, thickened, hardened; or that is not ſufficiently thin and diluted.

GRY, according to Mr. *Lock*, is a Meaſure containing $\frac{1}{10}$ of a Line: A Line is $\frac{1}{10}$ of an Inch, an Inch $\frac{1}{10}$ of a Philoſophical Foot, and a Philoſophical Foot is $\frac{1}{3}$ of a Pendulum, whoſe *Diadromes* or *Vibrations*, in the Latitude of 45 Degrees, are each equal to one Second of Time, or $\frac{1}{60}$ of a Minute.

GRYPHUS, [probably of γρυπὸς crooked, Gr.] a ſort of crooked Pincers uſed by Surgeons.

GUARANTEE [in *Law*,] a Warrantee, or him whom the *Warranter* undertakes to indemnify, or ſecure from Damage.

GUARANTEE, GUARANTY, ſignifies alſo a *Warranter*, or one who undertakes or obliges himſelf to ſee a ſecond Perſon perform, what he has ſtipulated to a third ; as a *Guaranty of a Treaty*.

GUARD, [in the *Military Art*,] ſignifies a Duty or Service paid by the Soldiers, to ſecure the Army or Place from the Surprizes and Efforts of the Enemy ; and of this there are ſeveral Kinds: As, 1. *The Main Guard* ; which is that from whence all other Guards are detach'd: Thoſe who are to mount the Guard, meet at the reſpective Captains Quarters, and are carried from thence to the *Parade* ; where, after the Whole Guard is drawn up, the ſmall Guards are detach'd for the *Poſts* and *Magazines* ; and then the ſubaltern Officers throw Lots for their Guards ; and are commanded by the Captain of the *Main Guard*. 2. *Advance Guard*, is that Party of Horſe or Foot which march before a Body, to give Notice of approaching Danger. When an Army is upon their March, the Grand Guards which ſhould mount that Day, ſerve as *Advance Guards* to the Army. That ſmall Body alſo of 12 or 16 Horſe, which are poſted under a Corporal or Quarter-maſter before the Grand Guard of a Camp, are called the *Advance Guard*. 3. *Grand Guard*, are three or four Squadrons of Horſe commanded by a Field Officer, and poſted before the Camp, on the Right and Left Wing, towards the Enemy, for the Security of the Camp. 4. In a Camp alſo every Battalion poſts a ſmall Guard, commanded by a ſubaltern Officer, about 100 Yards before its Front ; and this is called the *Quarter Guard*. As, 5. That ſmall Guard of Foot which a Regiment of Horſe mounts in the Front of the Regiment, under a Corporal, is call'd the *Standard Guard*. There is alſo, 6. The *Picquet Guard* ; which is a good Number of Horſe and Foot, which keep themſelves always in a Readineſs in caſe of an Alarm : The Horſe are ſaddled, and the Riders booted, all the while ; and the Foot draw up at the Head of the Battalion at the Beating of the *Tattou* ; but afterwards return to their Tents, where they are in a Readineſs to march upon any ſuddden Alarm. This Guard is to make Reſiſtance, in Caſe of an Attack, 'till the Army can get ready.

GUARDANT, the Term in Heraldry for a Lion born in a Coat of Arms, when his Face is turned towards the Spectator, and he appears in a Poſture of Guard or Defence (as it were) of himſelf.

GUARD *Cock* : See *Gardecaut*.

GUARDIAN *of the Spiritualities*, is he that collects the *Spiritualities* of any Biſhoprick during the Vacancy of that See. The Dean and Chapter of *Canterbury* are *Guardians of the Spiritualities* for the whole Dioceſe and Province, during the Vacancy of that Archbiſhoprick.

GUDGIONS, in a Ship, are the Eyes drove into the Stern-Poſt, into which the Pintles of the Rudder go, to hang her on.

GUERITE, in *Fortification*, is a ſmall Tower of Wood or Stone, plac'd uſually on the Point of a Baſtion, or on the Angles of the Shoulder, to hold a Centinel, who is to take care of the Ditch, and to watch out againſt Surprizes.

GUEST-ROPE, is that Rope by which the Boat is kept from *Steeving*, or going too much in and out, as ſhe lies in the Tow of a Ship.

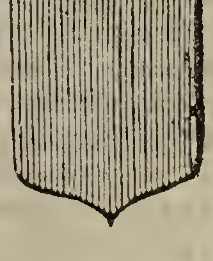
GULA or *Gullet* : See *Oeſophagus*.

GULE *of Auguſt*, is the Day of St. *Peter ad Vincula*, celebrated formerly and now on the firſt of *Auguſt*. See *Hoſpinion de Origine Feſtorum*, *Fol.* 85.

GULE, GOLA, [in *Architecture*,] a wavy Member, the Contour of which reſembles the Letter, commonly call'd by the *Engliſh* Workmen an *Ogee* ; and by the *Greeks* a *Cymatium*.

GULBE, [in *Architecture*,] the ſame with *Gorge*.

GULES : So the Heralds call the Red Colour in the Arms of Gentlemen ; but in thoſe of the Nobility they call it *Ruby* ; and in Sovereign Princes Coats *Mars*. 'Tis expreſſed in Engraving by perpendicular Strokes or Hatches, thus.



GULF, [in *Geography*,] is a Part of the Ocean or great Sea, which runs up into the Land thro' narrow Paſſages, which are called *Streights* ; as the *Gulf* of *Florida* in *America*, the *Arabian Gulf* or *Red Sea* in *Africa*, the *Perſian Gulf* in *Aſia*, and the *Gulf* of *Venice*, or the *Adriatick Sea* in *Europe*.

GUMMA *Gallicum*, is by ſome the Term for the eating out of a Bone in the *French Pox*.

GUMMATA, [in *Medicine*,] a ſort of Tumours, ſo called from the Reſemblance of their Contents to Gums.

GUN-*Powder*. The wonderful Exploſion of this miſchievous Compoſition (when it is kindled) ſeems to ariſe from hence : That the Sulphur and Coal-duſt being Bodies very quickly ſet on Fire, they do very ſwiftly accend the Nitre ; whoſe Spirit being thereby rarified, breaks out with a violent Exploſion, like the heated Vapour of Water out of an *Æolipyle*. The Sulphur alſo being of a volatile Nature, is itſelf alſo converted into Vapour, and ſo encreaſes the Exploſion ; and that Part of it which is of an Acid Nature, (as that Spirit which they call Oil of Sulphur *per Campanam*) upon the Accenſion, breaks out and entring into the fix'd Body of the Nitre, looſens and lets out its latent Spirit alſo, hereby producing a yet much greater Fermentation and Heat.

And if you mingle Salt of Tartar with Gun-Powder, and let that Mixture be gradually heated 'till it come to take Fire, the Exploſion will become much more quick and violent ; and this can ariſe from no other Cauſe than from the Action of the Vapour of the Gun-Powder on the Salt of Tartar. By what Means the ſmall Particles of Bodies do act upon one another with this immenſe Violence, you will find under the Word *Attraction*.

How to prepare Pulvis Pyrius, *or* Gun-Powder.

The Compoſition and Preparation of Gun-Powder, is not only very well known to ſuch as are profeſſed Pyrotechnicians, but likewiſe to many of thoſe who never make uſe of it but for Muſquets, Piſtols, and ſuch light Fire Arms : Nay, what is very odd, the very Peaſants in our Country have learned to make it with their own Hands, without the Help of any artificial Engines, or chymical *Apparatus* : For (and I think it will not be very improper in this Place, to make the Digreſſion) I have ſeen many of the Inhabitants of *Podolia* and *Ukrania*, whom we now call *Coſſacks*, who make their own Powder after a Method entirely contrary to the Practice of our Pyrotechnicians. For Example : They put certain Quantities of Saltpeter, Sulphur, and Charcoal, into an Earthen Pot, (the due Proportions of which they have attained to by long Uſe) then pouring freſh Water upon them, they boil them over a ſlow

Fire, for two or three Hours, 'till all the Water is totally evaporated, and that their Compoſition is become very thick; then taking it out of the Pot, they dry it in the Sun, or ſome warm Place, in a Thing like a Frying-pan; they then paſs it through a Pan, ſearce, and make it into very ſmall Grains. There are others of them that pound their Compoſition, and incorporate it in an Earthen Porringer, or grind it upon ſome ſmooth poliſhed Stone; then moiſten it, and corn it, and bring it to ſuch a degree of Perfection, that it ſerves them as well as if it had been prepared by the moſt ingenious Artiſt in the World.

It will therefore be to little purpoſe to dwell upon this Article, or to give a Detail of the Preparation of our Powder; ſo I ſhall only preſent you with ſome excellent and approved Compoſitions for the making three Sorts of Gun-powder.

Compoſition for Cannon-Powder.

	Pounds
Of Saltpetre	100
Of Sulphur	25
Of Charcoal	25

Of Saltpetre	100
Of Sulphur	20
Of Charcoal	24

Compoſition for Muſquet-Powder.

	Pounds.
Of Saltpetre	100
Of Sulphur	18
Of Charcoal	20

Of Saltpetre	100
Of Sulphur	15
Of Charcoal	18

Compoſition for Piſtol-Powder.

	Pounds.
Of Saltpetre	100
Of Sulphur	12
Of Charcoal	15

Of Saltpetre	100
Of Sulphur	12
Of Charcoal	15

As you pound or grind your mixture of Cannon or Muſquet Powder, you may ſprinkle it gently with freſh Water only, or Vinegar, Urine, or Brandy. But if you would have your Piſtol Powder ſtronger than ordinary, you muſt now and then ſprinkle your Compoſition whilſt it is in the Mortar with the following Liquor; with Water of Orange, Citron, or Lemon Peel, diſtilled with an *Alembick*, or any other Chymical Organ; and let it all be well pounded or ground for the Space of 24 Hours; then corn it very finely.

Now this Liquor is made of twenty Meaſures of Brandy, twelve Meaſures of Eſſence or Spirit of white Wine Vinegar, four Meaſures of Spirit of Nitre, two Meaſures of common Water of *Sal Armoniack*, one Meaſure of Camphire, diſſolved in Brandy, or pulverized with Sulphur; or, in ſhort, reduced to an Oil, with Oil of ſweet Almonds.

In the ſecond Part of our Artillery I ſhall give you the Figure of the Hand-Mill which is uſed in making Gun-Powder, together with a great many other Machines and Engines, which are uſually reſerved in *Arſenals*, and Magazines of *Artillery*.

It is a ſtrange and moſt aſtoniſhing Property of Gun-Powder, that it ſhould have a more violent Effect when corned, than when in a fine Flower or Meal; the Reaſon of which I ſhall leave to the Diſcuſſion of thoſe, who make it their particular Buſineſs to inſinuate themſelves into the wonderful Secrets of Nature. I content my ſelf with having been taught by long Practice, that if in any Gun the Powder be rammed down too hard, ſo that the Corns of it loſe their Figure, or are in the leaſt pulverized; it will by that Means be diveſted of much of its Force, and will not drive out the Bullet with that Violence it would have been capable of, if it had been gently puſhed down to the Bottom of the Piece. And we have ſometimes obſerved, that its Power has been ſo far diminiſhed by this Means, that it has hardly been able to overcome the Reſiſtance of the Bullet, and diſlodge it from the Piece. The ſame thing happens if Powder is wet, which being thereby deprived of its expulſive Force, burns lazily, and without Effect; ſo that if any Piece be charged with it, and you ſet Fire to it, it will be ſo far from being able to drive out the Ball, that it will all burn out at the Touch-hole. How it comes to paſs that Gun-powder, by being bruiſed and reduced to a ſoft Flower or Meal, loſes thus its Vertue and Activity, muſt be owing to the Rays of Fire, which, though it be the moſt ſubtile and active of all Elements, yet is not ſufficiently fine to penetrate and enkindle at once a hard compacted Body at the very Moment it ſeizes upon it. This Aſſertion needs no Proof to confirm it; for Experience ſhews us, with regard to Metals, that the more ſolid and hard they are, the leſs eaſily are they acted upon by Fire: On the contrary, ſuch as are more porous, and looſly compacted, are quickly heated; which is to be attributed to the Largeneſs of their Pores, which readily admit the Fire. This may be applied to Gun-powder; for when it is rammed and compelled into a ſolid Body, the Fire not meeting with Interſtices proper for its immediate Conveyance through the whole Maſs, it is obliged to conſume it by degrees, as long as any of it remains, except it be ſuffocated. Something of this kind may be ſaid of Powder that is ſcattered about, and is not gathered together before it is fired; but nevertheleſs with this difference, that in this Caſe the eſſential Strength of the Gun-powder, or rather the Fire in it, is not any way diminiſhed, but its Action is ineffectual, becauſe of the Diſtance of its Parts; it acts in this Caſe by a Succeſſion of ſmall Action, which might have been conſiderable if collected together into one Act. Thoſe who are but little verſed in Pyrotechnies, may have experienced the Truth of what I have here ſaid. The Reaſon I have given why Powder when it is corned is more active and powerful than when pulverized, may ſerve in ſome meaſure to clear up that Difficulty; add to which, the Vertue of the Saltpetre ſeems to be much more united with the Sulphur and the Charcoal when in a cloſe Corn, than when mealed or pulverized. To this let us add, that if you take a very long piece of Cannon, and fill it up to the Muzzle with well corned Powder and ſet Fire to it at the Muzzle, and not at the Touch-hole as uſual, neither the Fire nor the Powder will do the leaſt Damage in this Caſe to the Piece, in as much as the Fire acts upon the Powder by Progreſſion, and not inſtantaneouſly: Beſides, the Fire will move downwards, which is the Reverſe of its natural Property of acting upwards; or, to ſpeak more properly, it not being cloſely confined, and meeting with nothing to obſtruct its perfect Liberty, it burns out of the Muzzle of the Piece.

I cannort paſs over the Opinion of ſome who are not very knowing as to this Matter, and who imagine the larger any Gun-powder is corned, the more lively it will be; which at firſt does not appear unlikely, and ſeems to agree with what I have been ſaying above; but, on the other ſide, the Conſequence of it is wrong; becauſe large Grains are not ſo readily accended, or inflamed, as ſmall ones: And Experience in Fireworks teacheth us, that that Powder which is in the leaſt Corns, is more vigorous than that whoſe Grains are the largeſt; and the Reaſon is, becauſe the ſmall ones conceive the Fire more readily; add to this, that they are more impregnated with Saltpetre (the very Life of it all) than the others; and hence it is that they corn it ſmall for the Muſquet and Piſtol, &c. and, on the contrary, take leſs Trouble with it when deſigned for the Uſe of Cannon: For as all great Pieces of Ordnance naturally require a much greater Quantity of Powder than the ſmall portable Fire Arms, it is but reaſonable that the Powder prepared for the former, ſhould be coarſer than that deſigned for the latter; and indeed it is not only reaſonable, but neceſſary likewiſe, to the End that its Interſtices being the larger, the Fire may have the better Convenience of penetrating through the whole Maſs of it, and of accending it at once. Now *Nicholas Tartagalia*, in his Book III. Queſt. 10. gives this Reaſon why Muſquet and Piſtol Powder ought to be corned: It is (ſays he) to the end, that that Quantity of Powder, which is the exact Charge of ſuch Arms, may be more conveniently poured out of the Bandeliers, (which are little wooden Meaſures to hold juſt a Load) and that it may run the more freely down the Barrel of the Piece; (although the Bandelier is exactly of the ſame Calibre as the Piece) which could not eaſily be done if the Powder was in a Flower, or pulverized; becauſe the ſmall Particles of it cohering together, it would all tumble down at once into the Barrel, and meet with ſome Difficulty in its Deſcent, particularly if the Priming-pan was ſhut cloſe; for in that Caſe it would happen that the Air in the Bottom or lower Part of the Barrel, having no opportunity of eſcaping out at the Touch-hole, and the Denſity of the deſcending Flour not admitting of its Excurſion upwards, it would in the end be ſo violently compreſſed, as to repel the Powder or Flour by its elaſtick Force; ſo that it would be impoſſible to load ſuch Arms with it, with any manner of Expedition. But this Accident never happens with regard to grained Powder, in as much as the Air in the Barrel is at perfect Liberty, by having the Power of eſcaping through its Interſtices. However, great Pieces of Artillery are by no means liable to this Inconvenience; becauſe the Powder is always conveyed into them by a Ladle. Here is a way of Reaſoning that has ſome ſhew of Truth on its Side, though it is far from accounting ſufficiently for the Neceſſity of corning Gun-powder: But he is moſt ſtrangely out of the way, when he ſays, that Cannon Powder need not be corned at all; which I abſolutely deny, and cannot but think, from his wretched manner of arguing, that he (*Tartagalia*) was ſo far from having ever heard or ſeen the wonderful Effects of Cannon Powder upon ſuch perilous Occaſions, as the Wars in his Time abounded with, that he never had ſo much as a Sight of any of the Powder itſelf.

GUN-*Room*, [in a *Ship*,] is the Apartment under the great Cabin; where the Maſter Gunner and his Crew rendezvous, get ready their Cartridges, &c. and do all Things belonging to their Buſineſs.

GUNTER'S *Line*, is the common Line of *Numbers*, invented firſt by Mr. *Gunter*, and ſo commonly known that there is no need of a Deſcription of it here; it being not only done by the Inventor in his Book of the Sector, but alſo by *Everard*, *Brown*, *Partridge*, in their ſliding Rules, and almoſt every one that hath written of Practical Mathematicks.

GUNTER'S *Line*. I ſhall now give you the Conſtitution and Uſe of this famous Line. Provide a Ruler of any Metal, Wood, &c. that is proper, of any Length, (the larger the better) and according to the deſigned Length of your Line of Numbers, divide a Line of the ſame Length into 10000 equal Parts; and then having Recourſe to a Table of Logarithms, take off from the ſaid Scale the artificial or logarithmic Numbers, anſwering to the Diviſion of your intended Line, (omitting the Index or Characteriſtick) and theſe Diſtances will graduate your Line of Numbers, and divide it into its *Primes*, *Tenths*, *Centeſms*, &c.

For the firſt eminent Nine unequal Parts, which have the Nine Digits annex'd, are call'd *Primes*; and the Subdiviſions of thoſe into Ten leſſer Parts are call'd *Tenths*; each *Tenth* is divided, or ſuppoſed to be ſo, into *Centeſms*; and thoſe *Centeſms* into *Millains*, as Mr. *Wingate* calls them. *Numeration* therefore, as they call it, on the Line will be very eaſy; and you may know readily how to find the Point expreſſing any Number of not above 4 Places on it. Suppoſe the Number were 4867; the Figure 4, on the Line, expreſſes the Place of 4000; thence accounting 8 Tenths farther to the Right-hand, you will have the Place of 4800; and in the next Tenth, reckoning forward ſix Subdiviſions, you will have the proper Point for 4860; and then in the next *Centeſm*, taking or gueſſing at 7, (and Practice will make this eaſy) you will find the Point (nearly) for 4867.

But if your Number had been but of 3 Places, as 486; then the Digit Figure 4 on the Line would only have repreſented 400. And if it had been but of two Places, or a ſingle Figure, the Figure 4 on the Line would have been 40, or barely 4 Units accordingly. 'Tis plain alſo, that any Decimal Fractions and unfixt Numbers will be repreſented on the Line as eaſy as Whole Numbers, regard being only had to the Point or Line of Separation.

PROBLEM I.

Two Numbers being given, to find a Third or Fourth Geometrical Proportion.

The Line being nothing but a Series of Logarithms or artificial Numbers in an arithmetical Proportion; 'tis plain, if the Compaſſes be extended from the firſt Term to the ſecond, the ſame Diſtance will reach from the third to the fourth, from the fourth to the fifth, and ſo on continually; only you muſt turn the Leg forward when a greater Term is requir'd; and backward, or towards the Left Hand, when the proportional Term required is to be leſs; as common Senſe will direct. Thus if the two Numbers had been 10 and 12, the third Proportional forward would be 14.4 and backward 8.3, &c. So that all Queſtions in any practical Art, where ſuch kind of Proportionals are requir'd, may, you ſee eaſily, be wrought by the *Gunters Line*.

PROBLEM II.

To multiply or divide one Number by another.

Since in all Multiplication, As 1 is to the one Factor :: So is the other, to the Product. And ſince in all Diviſion, As the Diviſor is to Unity :: So is the Dividend to the Quotient. Either of theſe Rules may be eaſily wrought by the Line of Numbers, ſince 'tis only finding a fourth Proportional to three Terms given. The Extent of the Compaſſes therefore, from 1 to the Multiplier, will reach forward in whole Numbers from the Multiplicand to the Product: And the Extent from the Diviſor to Unity, will reach from the Dividend to the Quotient. If either or both Numbers be Decimal Fractions, the Nature of the Product or Quotient muſt be determined by the Rules given about managing of ſuch Fractions; but the ſame Figures will be found by the Line, let the Nature or Value of the Numbers be what it will. *N. B.* How many Places muſt be in the Product or in the Quotient, may be diſcovered eaſily by the Rules of common Arithmetick, and conſequently to what Exactneſs you muſt endeavour to go in the Line.

PROBLEM III.

Three Numbers being given, to find a Fourth in a Duplicate Ratio or Proportion.

This relates to the Proportion of Surfaces and Area's, which, when ſimilar Figures, are in a Duplicate Ratio of their Homologous Sides. Let the Diameter of a Circle be 14 Inches, and its Area 154; What is the Area of a Circle, whoſe Diameter is 28?

Extend the Compaſſes from 14 to 28; that Extent will reach from 154 to 308, and thence to 616, the Area requir'd.

PROBLEM IV.

To three Numbers given, to find a Fourth in a Triplicate Proportion.

This relates to Solids, and their Proportion to Lines.

Let the Diameter of an Iron Bullet be 4 Inches, and its Weight 9 *lb.* What will a Bullet weigh, whoſe Diameter is as much more; *viz.* 8 Inches?

The Extent of the Compaſſes from 4 to 8, applied to 9, and turn'd three Times, will at laſt fall on 72, the Weight ſought.

PROBLEM V.

To find a Mean Proportional between any two Numbers given: As ſuppoſe between 8 *and* 32.

Extend the Compaſſes from 8 in the Left Hand Part of the Line, to 32 in the Right, and then biſſect that Diſtance; the half ſhall reach either from 8 to 16 forward, or from 32 to 16 backward.

PROBLEM VI.

To find two or more mean Proportionals between two Numbers given.

Divide the Diſtance between the two Numbers into a Number of equal Parts, which ſhall exceed the *Means* required by one; (as if 2 are required into 3, if 3 are required into 4, *&c.*) So ſhall the Feet of the Compaſſes, when turned from either of the Numbers towards the other, mark out the middle Proportionals required.

PROBLEM VII.

To extract the Square Root of any Number.

Biſſect the Diſtance between 1 on the Scale, and the Point which repreſents the Number; and the Half being ſet from 1, will give the Point repreſenting the Root.

PROBLEM VIII.

For the Cubick Root, or that of any Higher Power.

You muſt divide the Diſtance on the Line between 1 and the given Number, into as many equal Parts as the Index of the Power expreſſes; and one of thoſe Parts ſet from 1, on the Line, will find the Point repreſenting the Root requir'd. Thus if the Cubick Root of 1728 were requir'd: Divide the Diſtance between 1 and 1728 into three equal Parts, (3 being the Index of the Cube or Third Power) and one of thoſe ſet from 1 forward, will find 12 the Root ſought.

N.B. *Only obſerve to* Point the Number *whoſe Root is to be Extracted (as in Extraction of Roots in Common Arithmetick) and then, if the laſt Point fall on the firſt Figure of the Number, the former Way of accounting on the Line will do: But if the laſt Point fall on the ſecond Figure or Place in the Number (reckoning from the Left Hand towards the Right;) then account the whole Length of the firſt Line of Numbers in, and carry the Account on in the ſecond: As ſuppoſe the Root of* 36 *were requir'd; begin to take the* 36 *from the firſt* 1 *on the Left Hand in the Line, and account the* 36 *on in the ſecond Line; and then half that Diſtance being ſet from the firſt* 1, *will reach to* 6, *the Root in either the firſt or ſecond Line. So alſo if the Square Root of* 1440 *had been ſought: Account the whole firſt Line for your firſt* 1000; *and then the* 440 *on in the Tenths between the ſecond* 1 *and* 2: *So will half the Diſtance between the firſt* 1 *and that Point, reach from* 1 *to near* 38 *in either Line.*

PROBLEM IX.

For the Uſe of the Line in Trigonometry. *See that Word.*

The Uſe in Superficial Meaſure.

PROBLEM X.

Having the Diameter of a Circle, to find the Circumference.

Extend the Compaſſes from 1 to the Number expreſſing the Diameter; and then the ſame Extent will reach from 3.142 to the Circumference.

PROBLEM XI.

Having the Diameter, to find the Superficial Content.

The Extent, as before, from 1 to the Diameter being found, ſet it twice from the Point of .7854 on the Line, and then it will reach to the Number expreſſing the *Area.*

PROBLEM XII.

The Breadth of a Rectangle being given in Inch-Meaſure, and the Length in Foot-Meaſure, to find the Area in Feet.

Extend the Compaſſes from 12 on the Line to the Breadth in Inches; and that will reach from the Length in Feet, to the Area in Square Feet.

PROBLEM XIII.

The Length and Breadth being given in Foot-Meaſure, to find the Area in Yards.

The Extent from 9 to the Breadth, will reach from the Length to the *Area* in Yards.

PROBLEM XIV.

To find the Area in ſingle Perches.

The Extent from 16.5 to the Breadth, will reach from the Length to the Content in Perches: And the Extent from 160 to the Breadth, will reach from the Length to the Content in Acres, *&c.*

The Uſe in Solid Meaſure.

PROBLEM XV.

The Depth and Breadth of a Right-angled Parallelopipid being given in Inch-Meaſure, and the Length in Foot-Meaſure, to find the Content in Feet.

The Extent from 12 to the *Breadth* and *Depth* in Inches, being twice repeated from the *Length* in Feet, will reach to the Content in Feet. If the Parallelopipid be Oblique-angled, you muſt find a Mean Proportional between the Breadth and Depth: And then the Extent from 12 to the Mean Proportional being twice repeated from the Length in Feet, will reach to the Content in Feet.

PROBLEM XVI.

To find the Solidity of a Cylinder, whoſe Baſe and Length is given.

The Extent from 1 to the Baſe, will reach from the Length to the Solid Content.

PROBLEM XVII.

Having the Diameter of a Sphere, to find its Surface and Solidity.

The Extent from 1 to the Diameter, repeat twice from the Point of 3.142, and that will reach to the Number expreſſing the Surface: And if you repeat the Extent from 1 to the Diameter, three rimes from .5238 on the Line, that will reach to the Solid Content requir'd.

Its Uſe in Intereſt and Annuities.

PROBLEM XVIII.

To find what any Sum will encreaſe at 6 per Cent. *Intereſt upon Intereſt, if forborn a certain Time. Suppoſe* 273 l. *for* 5 *Years.*

Extend the Compaſſes from 100 to 106, and then repeat that Diſtance five times from 273, ſo will the Point at laſt fall on 402.1, or 402 *l.* 2 *s.* which is the Principal and Intereſt requir'd.

PROBLEM XIX.

A Sum of Money being due for a Time to come, to know what 'tis worth in ready Money.

This is the Reverſe of the laſt.

PROBLEM XX.

A Yearly Rent or Annuity being forborn for a Term of Years, to find what the Arrears will amount to, at the Rate propoſed.

As ſuppoſe a Rent or Annuity of 12 *l. per Ann.* were forborn ſixteen Years; What will the Arrears amount to at the Rate of 8 *l. per Cent.* Intereſt?

Firſt find the Principal anſwering to 12 *l.* by ſaying, If 8 *l.* hath 100 *l.* for its Principal, what will 12 *l.* have? Anſwer, 150 *l.* Then I find (by *Probl.* 18.) that 150 *l.* being forborn ſixteen Years, amounts, at 8 *l. per Cent.* to 513.9, or 513 *l.* 18 *s.* Out of which deducting 150 *l.* the Principal anſwering to the Annuity given, there remains 363 *l.* 18 *s.* the Sum of all the Arrears requir'd.

PROBLEM XXI.

To know what Annual Rent or Annuity is worth in Ready Money.

Find (by the Precedent) the Value of the Arrears at the End of the Term propoſed; and then (by *Probl.* 19.) what thoſe Arrears are worth in Ready Money; and that will be the requir'd Price or Value of the propoſed Rent or Annuity; *v. gr.* I find the Arrears of 12 *l. per Ann.* at ſixteen Years end, and at 8 *l. per Cent.* amount to 363 *l.* 18 *s.* And I find (by the 19th *Probl.*) that the ſaid Sum is worth in Ready Money 106 *l.* 4 *s.* and conſequently I conclude, that the Leaſe or Annuity propoſed is worth in ready Money (after 8 *l. per Cent.*) 106 *l.* 4 *s.*

If the Term of the Annuity don't commence preſently, but ſuppoſe at five Years hence or to come, then you muſt find what the Arrears for all that Time are worth in ready Money; that is, what they are worth, when forborn in this Inſtance for twenty one Years. The Anſwer is, 72 *l.* 6 *s.*

GUNTER'S *Quadrant*, is an Inſtrument made in Wood or Braſs, curiouſly contrived to find the Hour of the Day and *Azimuth*, with moſt Propoſitions of the Globe; as alſo Heights and Diſtances.

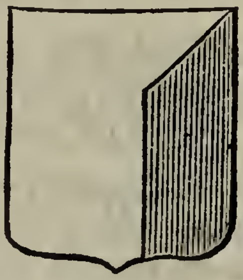
You have a full Deſcription of it in Mr. *Gunter*'s Book of the Sector; but 'tis by no means ſo good to find the Hour of the Day as Mr. *Collin*'s Quadrant. See *Quadrant*.

GUNTER'S *Scale*, called by the Common Seamen uſually, *The Gunter*, is a large plain Scale, with the Lines of artificial Sines and Tangents fitted ſo to a Line of Numbers, that they can by the Compaſſes work all Queſtions in plain Dialling, *&c.* with tolerable Exactneſs, if the Scale be large and good. It hath its Name for being the Invention of the above-named Mr. *Gunter*, and is now commonly put on all our Scales, and on our Sectors, where they are uſually called, *The Artificial Lines.*

GUNWALE, or *Gunnel of a Ship*, is that Piece of Timber which reaches on either ſide of the Ship from the Half-Deck to the Fore-Caſtle, being the uppermoſt *Bend* which finiſheth the upper Works of the Hull in that Part, and wherein they put the Stanchions which ſupport the Waſte-Trees; and this is called the *Gunwale*, whether there be Guns in the Ship or no: And the lower part of any *Port*, where any Ordnance are, is alſo termed the *Gunwale*.

GURGULIO, the ſame with *Cion*, or the *Epiglottis*: Which ſee.

GUSSET, [in *Heraldry*,] is form'd of a Line drawn from the Dexter or Siniſter Angle of the Chief, and deſcending diagonally to the Point; from whence another Line falls perpendicularly upon the Baſe, as in the Eſcutcheon annexed. It is ſaid to be appropriated to laſcivious, effeminate, or wanton Perſons.



GUTTA *Roſacea*, is a Redneſs with Pimples, wherewith the Cheeks, Noſe, and whole Face is deformed, as if it were ſprinkled with red Drops: Theſe Pimples or Wheals often increaſe to that degree, that they render the Face rough and horrid, and the Noſe monſtrouſly big. *L.*

GUTTA SERENA, or *Amauroſis*, is a Dimneſs, or even total Loſs of the Sight, cauſed by a watery Humour flowing down from the Brain upon the Optick Nerves. *L.*

GUTTÆ, or *Drops*, [in *Architecture*,] are certain Parts in Form of little Bells, which, to the Number of Six, are put below every *Triglyph* in the *Architrave* of the *Dorick* Order. They are ſo called by Architects from their Shape, repreſenting the *Drops* of Water, which having run along the *Triglyphs*, ſtill hang under the Cloſure between the Pillars. *L.*

GUTTAL-*Cartilage*, [in *Anatomy*,] is that which includes the third and fourth Griſtle of the *Larynx*, which ſeem to be but one, by reaſon of the common Membrane with which they are covered.

GUTTE, } [in *Heraldry*,] is when a Thing is
GUTTY, } repreſented as charg'd or ſprinkled with Drops.

GUTTE *de l' Elau*, Drops of Water: Theſe in Heraldry they paint Argent or White. *F.*

GUTTE *de Larmes*, when they are Drops of Tears, and theſe in Heraldry are painted Blue or Azure. *F.*

GUTTE *de Or*, Drops of melted Gold; all which kinds are ſometimes born in Eſcutcheons. *F.*

GUTTE *de Sang*, the Term in Heraldry for Drops of Blood born any how in a Coat of Arms: If the Drops are of any other Subſtance, they are called accordingly. *F.*

GUTTURIS *Os*, the ſame that is called *Hyoides Os.* L.

GUTS: See *Inteſtines.*

GUVE *de Ronde*, a Term in *Fortification*, ſignifying the ſame as a ſimple or a *ſingle Tenaille.* See *Tenaille*. L.

GUZES, [in *Heraldry*,] are Roundles of a ſanguine or murrey Colour.

GUY: A *Guy* in a Ship, is any Rope uſed to keep off things from bearing or falling againſt the Ship Side when they are to be hoiſted in: Thus, if any thing is to be haled in over the Gunwale, it is gently eaſed in by a *Guy-Rope* faſtened uſually to the Stanchions of the Waſte-Trees.

That Rope alſo which is made faſt to the Foremaſt at one End, and is reeved thro' a ſingle Block ſeized to the Pendant of the Winding-Tackle, and then again reeved through another ſeized to the Fore-maſt, and whoſe Uſe is to hale forward the Pendant of the Winding-Tackle, is alſo called a *Guy*.

GWAIF, the ſame with *Waif*; *i. e.* ſuch Goods as Felons when purſued, caſt down and leave in the High-way; which become a Forfeiture to the King or Lord of the Mannor, unleſs the Right Owner legally claim them within a Year and a Day.

GYMNASTICKS, that Part of Phyſick, which treats of the Rules that are to be obſerved in all ſorts of Exerciſes, in order to the Preſervation of Health. This is ſaid to be invented by one *Herodicus*, born at *Selymbra* a City of *Thrace*, or, as ſome ſay, at *Leutini* in *Sicily*: He was Brother to *Georgius* the famous Rhetorician and Philoſopher.

This *Herodicus* was at firſt Maſter of an Academy, where young Gentlemen came to learn Warlike and Manly Exerciſes; and whom he obſerving to be very Healthful on *that Account*, he made *Exerciſe* become an Art, in reference to the Recovery of Men out of Diſeaſes, as well as preſerving them from them, and called it *Gymnaſtick*, which he made a great Part of his Practice of Phyſick: But *Hippocrates*, who was his Scholar, blames him ſometimes for his *Exceſſes* in this kind of Phyſick, and his want of Judgment in preſcribing this Method of Cure in Fevers, *&c.* And *Plato*, in his *Phædr.* exclaims againſt him with great Warmth on this Account, and ſaith, he uſed to enjoin his Patients to walk from *Athens* to *Megara*, (which is about 25 Miles) and to come home again on Foot as they went, as ſoon as ever they had once but touch'd the Walls of the City.

GYNÆCIA, [γυναικία of γυνή, Gr. a Woman,] in general, are the Accidents incident to Women; but *Hippocrates* takes them more ſtrictly for the Courſes. *Blanchard.*

GYNÆCOMASTOS [of γυναικος of a Woman, and μαϛὸς, Gr. a Teat,] a preternatural Tumour in the Breaſt of a Man, when it grows as big as a Woman's.

GYNÆCOMASTUM, [of γυναικος of a Woman, and μάϛος, Gr. a Breaſt,] is the growing of the Breaſts. *Blanchard.*

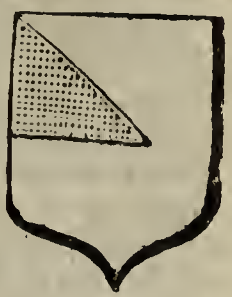
GYPSE, } [γύψος, Gr.] a coarſe ſort of
GYPSUM, } Talk; or a ſhining tranſparent Stone, found in the Quarries of *Montmartre* near *Paris*. This Stone, calcin'd in a Kiln, and pounded in a Mortar, and ſifted, and mix'd up with Gum or Size-Water, and Colours, makes an artificial and counterfeit Marble, to that Perfection, as to deceive both the Eye and Touch.

GYPSUM, [of γύψος, Gr.] a ſort of Stone found in Quarries, which being burnt, and wrought up with Water, makes the fine Plaiſter of *Paris.*

Some confound the *Gypſe* with the *Gypſum* of the Antients; but they are different, for the *Gypſe* is not fit for making of Plaiſter.

GYROMANCY, [γυϱομαντεία of γυϱὸς a Circle, and μαντεία, Gr. Divination,] a kind of Divination perform'd by walking round, or in a Circle.

GYRON, an Ordinary in *Heraldry*, conſiſting of two ſtrait Lines iſſuing from divers Parts of the Eſcutcheon, and meeting in the Feſſe Point; thus,



He beareth *Sanguine a Gyron iſſuing from the Dexter Point Or.*

* * *

HABEAS *Corpora*, is a Writ that lies for the bringing in a Jury, or ſo many of them as refuſe to come upon the *Venire facias*, for the Trial of a Cauſe brought to iſſue. *L.*

HABEAS *Corpus*, is a Writ which a Man indicted for a Treſpaſs before Juſtices of Peace, or in a Court of any Franchiſe, and being apprehended and impriſoned for the ſame, may have out of the King's-Bench, to remove himſelf thither at his own Coſts, and to anſwer the Cauſe there. *L.*

And the Order of this Caſe is, firſt to procure a *Certiorari* out of the *Chancery*, directed to the ſaid Juſtices for the removing of the Indictment into the King's Bench; and upon that, to procure this Writ to the Sheriff, for the cauſing of his Body to be brought at a Day.

HABENDUM, is a Word of Form in a Deed or Conveyance, every of which muſt have two Parts, *viz.* the *Premiſes*, and the *Habendum.* L.

The Office of the *Premiſes* is to expreſs the Names of the Grantor, Grantee, and the Thing granted.

The Office of the *Habendum* is to limit the Eſtate ſo, that the general Implication of the Eſtate, which (by Conſtruction of Law) paſſeth into the *Premiſes*, is by the *Habendum* controlled and qualified.

HABENTES *Homines*, *Fæſting Men*; as they are call'd in a Charter of *Cenulph* King of the *Mercians*, *Anno* 821. *Du Freſne* will have theſe to be no more than *Divites*, Rich Men: But no doubt the Word implies a ſtricter Senſe; and ſignified either the King's Guard or Retinue, which were at the King's Pleaſure to be *Feaſting Men*, or plentifully entertained at the Houſes of his Tenants: Or rather, thoſe old Servants which were commended to the Religious by the King; and ſo *faſtned* on them for *Corrodies*, or Maintenance for Life. Some think that they were only *Pledges* and *Sureties*, or *Friburghs*; which under their Chief or Principal Tything Man, were to keep the King's Peace, and to be accountable for the Breach of it.

HABERE *facias Seiſinam*, is a Writ Judicial, which lieth where a Man hath recovered Lands in the King's Court, directed to the Sheriff, and commanding him to give *Seiſin* of the Land recovered. This Writ is ſometimes iſſued out of the Records of a Fine executory, directed to the Sheriff of the County where the Land lieth, commanding him to give the Cogniſee, or his Heirs, *Seiſin* of the Land whereof the Fine is levied, which Writ lieth within the Year after the Fine or Judgment, upon a *Scire facias*, and may be made in divers Forms. *L.*

There is alſo a Writ called *Habere facias Seiſinam, ubi Rex habuit annum, diem, & vaſtum*; which lies for the Delivery of Land to the Lord of the Fee, after the King has taken his Due of Lands of him that was convicted of Felony.

HABERE *facias viſum*, is a Writ that lies in divers Caſes, where View is to be taken of the Lands or Tenements in queſtion. *L.*

HABIT, [in *Phyſick*,] is what is otherwiſe call'd the Temperament or Conſtitution of the Body, whether obtain'd by Birth, or manner of Living.

HABITATION, [in the *Civil Law*,] is the Term for one of the perſonal Services, by which a Man hath a Right to live in the Houſe of another without Prejudice to the Propriety.

HABITUDE, is a Diſpoſition of the Mind, or Body, acquir'd by reiterated or repeated Acts; as Skill and Knowledge in the Sciences, Virtue, Vice, Excellence in Painting, Writing, Dancing, *&c.*

HABITUDE, [with *Schoolmen*,] ſignifies the Reſpect or Relation that one Thing bears to another. In which Senſe it is one of *Ariſtotle*'s Categories.

HADBOTE, was a Recompence made for the Violation of Holy Orders, or Violence offer'd to Perſons in them.

HÆLOSIS, according to ſome, is a reflected Inverſion of the Eye-lid.

HÆMALOPS, [Αἱμαλὼψ of ἅιμα Blood, and ὤψ, Gr. the Eye,] the Extravaſation of Blood about the Eye, occaſion'd by a Blow or Contuſion, commonly called a *Blue Eye*: Alſo the Redneſs of the Eyes proceeding from an Inflammation, or the Diſtenſion of the Blood-Veſſels in the Eye, or that which we call a *Blood-ſhotten Eye.*

HÆMATITES [Αἱματῖτης of ἅιμα, Gr. Blood,] a Blood-Stone thus called, either on account of its reſembling dry curdled Blood, or from a Quality it has of ſtanching Blood.

HÆMATOCELE, [Αἱματωκηλη of αἷμα and κηλὴ, Gr. a Tumour,] any Tumour charged with Blood.

HÆMATOMPHALOCELE, [of αἷμα Blood, ὄμφαλος a Navel, and κηλη, Gr. a Tumour,] a Tumour in the Navel with turgid Blood.

HÆMATOSIS, [Αἱμάτωσις, Gr.] the ſame with *Sanguification*; it is performed in all the Parts of the Body, and not in any peculiar Part, as the Heart, Liver, Spleen, as ſome formerly imagined. See *Blood.*

HÆMOIDA, [Αἱμωδια of αἷμα Blood, and ὀδοὺς, Gr. a Tooth,] a painful Numneſs of the Teeth, proceeding from the Irritation of the Membranes that ſurround their Roots, or of the Nerves that are diſperſed through their Subſtance. 'Tis uſually occaſioned by the eating of acid Fruits, or the vomiting of acid Humours: We commonly ſay in *Engliſh*, that the Teeth are ſet on Edge.

HÆMOPTYSIS, [ʽΑιμωπτυσις of αἷμα and πτύω, Gr. to ſpit] is the ſpitting of Blood from the Lungs, which proceeds either from a ſweating out at the Glandules of the *Larynx*, with which its *Tunick* is cloathed within; to wit, when the Openings of the Arteries are too much relaxed; or from ſome great Veſſels that are broke, or out of the little Bladders of the Lungs themſelves. *Blanchard.*

HÆMORRHAGIA [ʽΑιμοῤῥαγια, of αἷμα and ῥηγνυμὶ, Gr. to break,] is a Flux of Blood at the Noſtrils, Mouth, or Eyes, *&c.*

HÆMORRHOIDES, [ʽΑιμοῤῥοιδες of αἷμα and ῥέω, Gr. to flow,] are ſwelling Inflammations in the *Rectum*, or about the Fundament, red and painful, which ſometimes ſend forth Blood or Matter. *Blanchard.*

HÆMORRHOIDICAL-*Veins*, are either *Internal* or *External.*

The *Internal* are Branches of the third and laſt Diviſion of the *Vena Meſenterica*, which is it ſelf the right Branch of the *Porta:* This is ſpread thro' the middle of the *Meſenterium*, and goes to that Part of the *Colon* which lies on the Left Side to the *Rectum*, and thence down to the *Anus.*

The *External Hæmorrhoidical-Veins* ariſe from the *Vena Hypogaſtrica*, and ſometimes from a double Branch of it ſpreading about the *Sphincter* of the *Anus*; and this Hypogaſtrick-Vein is, in it ſelf, part of the internal Branch of the *Vena Iliaca.*

HÆREDE *Abducto*, is a Writ that lieth for a Lord, who having the Wardſhip of his Tenant under Age, by Right cannot come by his Body, for that he is conveyed away by another. *L.*

HÆREDE *deliberando alii qui habet cuſtodiam terræ*, is a Writ directed to the Sheriff, willing him to command one, having the Body of him that is Ward to another, to deliver him to him, whoſe Ward he was by reaſon of his Lord. *L.*

HÆRETARE, [in *Law*,] ſignifies to give a Right of Inheritance, or to make the Donation Hereditary to the Grantee and his Heirs. *L.*

HÆRETICO *Comburendo*, is a Writ that lies againſt him that is a Heretick; *viz.* that having once been convicted of *Hereſy* by his Biſhop, and having abjured it, afterwards falling into it again, or into ſome other, is thereupon committed to the Secular Power. Sir *Edward Coke*, in his 12th *Report*, *Fol.* 93. is of Opinion, that this Writ lies not at this Day. *L.*

HAIL. Dr. *Wallis*, in a Letter from *Oxon* to the Secretary of the Royal Society, and printed in the *Tranſactions*, obſerves that *Hail* is very often an Attendant on Thunder and Lightning; (of which, ſee the Word *Thunder.*) And 'tis well known, that in our artificial Congelations, a Mixture of Snow and Nitre, or even common Salt, will cauſe a very ſudden Congelation of Water. Now the ſame in the Clouds may cauſe *Hail-Stones*; and the rather, becauſe not only in ſome prodigiouſly great, but alſo in common *Hail-Stones* there ſeems ſomewhat like Snow rather than Ice, in the midſt of them. And as to thoſe very large *Hail-Stones*, weighing ½ or ¼ of a Pound; by the Violence of their Fall 'tis manifeſt they muſt have deſcended from a great Height: And tho' perhaps in their firſt Concretion, or Congelation, their Bulk might be but of the moderate Size of common *Hail*, yet in their long Deſcent, if the *Medium*, through which they fell, were alike inclined to Congelation, they might receive a great Acceſſion to their Bulk, by, perhaps, many of them coaleſcing and incorporating into one; as in that ſtrange Shower of *Hail* in *December* 1672. whereof their hung on the Trees a great deal in the form of Icicles, of a Foot or more in Length.

HAIL, [in *Meteorology*,] is an aqueous Concrete in the Form of white or pellucid Globules or Sphericles, that deſcend out of the Atmoſphere. It is ſuppos'd to be formed of Drops of Rain, frozen as they paſs through the middle Region. It aſſumes various Figures, according to the Degrees of Heat or Cold of the Air, which the Parts of the liquified Clouds paſs through, being ſometimes angular, more commonly roundiſh, and ſometimes pyramidal, *&c.* at other times thin and flat, Star-like, with ſix equal Points, *&c.* It uſually attends Thunder and Lightening; the Nitre that contributes to the one, having a large Share in the Production of the other.

Others ſuppoſe Hail to be the Fragments of a frozen Cloud half melted, and thus precipitated and congealed again.

The *Carteſians* accordingly define *Hail* to be a Cloud liquified either wholly or in part, which tending downwards by its own Gravity, is frozen by the Impreſſion of ſome very cold Wind in its Paſſage, and is thus precipitated moſt commonly in round tranſparent Globes; and that the Hail-Stones are pellucid, if the Cloud has been wholly liquified; but otherwiſe, only partly ſo.

HAIL: To *hail* a Ship, is either to call to her to know from whence ſhe is, and whither ſhe is bound; or elſe to ſalute her, and wiſh her Health.

HAILWORK-FOLK; *i. e.* Holy Work-Folk, or People who hold Lands for the Service of Repairing or Defending ſome Church or Sepulchre: For which pious Labours they were excuſed formerly from Feudal and Military Services.

HALE: To *hale* a Ship, is the ſame thing as what we call *pulling a-ſhore.*

HALF-*Bloom*, is the Term for a round Maſs of Metal, which comes out of the Finery in all Iron-works: See *Iron.*

HALF-*Moon*, [in *Fortification*,] is an Outwork that hath only two Faces, forming together a Salient-Angle, which is flanked by ſome Part of the Place, and of the other Baſtions.

Theſe *Half-Moons* are ſometimes raiſed before the Curtain, when the Ditch is a little wider than it ought to be; in which Senſe 'tis much the ſame with a Ravelin, only the Gorge of an *Half-Moon* is made bending in like a Bow or Creſcent, and is moſt times uſed to cover the Point of a Baſtion, whereas Ravelins are placed before the Curtain; but they are defective, as being ill Flanked.

HALF-*Tangent Lines:* See *Scale.*

HALF-*Tongue*, or *Party-Jury*, is a Jury empanell'd in a Cauſe where a Stranger is a Party; whereof the one Part conſiſts of Denizons, the other Half of Strangers: And the ſame is uſed in Pleas, where one Party is a Denizon, the other a Stranger. This way of Trial was firſt enacted by a Statute of *Edward* III.

HALLAGE, is a Fee due for Cloths brought for Sale to *Blackwell-Hall* in *London*; and alſo the Toll that is due to the Lord of a Fair or Market, for ſuch Goods as are vended in the Common Hall of the Place.

HALLIARDS, in a Ship, are thoſe Ropes by which they hoiſe up all her Yards. The Croſs-Jack and the Sprit-ſail Yard indeed have no *Halliards*, becauſe they are always ſlung; tho' in ſmall Craft, or Veſſels, they have *Halliards* to the Sprit-ſail Yard.

HALO, or *Halos*, is a certain Meteor in Form of a bright Circle or Ring that ſurrounds the Sun, Moon, or Star, but more eſpecially the Moon.

Theſe *Halo's* or Crowns do ſometimes appear colour'd like the Rainbow: And our incomparable Sir *Iſaac Newton* gives a Hint of the Solution of this Phænomenon in his Opticks, *Pag.* 111. ſhewing that it ariſes from the Sun or Moon's ſhining thro' a thin Cloud, conſiſting of Globules of Hail or Water all of the ſame Size. And he gives you two Obſervations of his own, of the actual Appearance of colour'd *Halo's*; one about the Sun, *June* 1692; the other round the Moon, *Febr.* 19. 1694, at Night.

HALO. Mr. *Huygens (vid. Philoſoph. Tranſ.* N. 60.) endeavours to account for the Appearance of *Halo's*, or Circles round the Sun, thus: That they are formed by ſmall round Grains of a kind of Hail made up of two parts; one of which is opake and incloſed in the other, which is tranſparent; and the ſame way he accounts for the *Parhelia*; only there he imagines that the icy Grains are of an oblong Figure, and rounding at the Ends like Cylinders with round convex Tops. Where ſome of theſe Cylinders are in an erect Poſition, the Circle they form will be white, and is cauſed by the Reflexion of the Rays of the Sun on the Surface of theſe Cylinders. He proceeds afterwards to account for the colour'd *Halo's* and *Parhelia* from the the ſame *Hypotheſis*, and produces an Experiment of a Glaſs Cylinder of a Foot long, and having within an opake Kernel, (which was a Cylinder of Wood) and the ambient Space was filled with Water: Which Cylinder being expoſed to the Sun, and the Eye diſpoſed in proper Places, the ſeveral ſucceſſive Reflexions and Refractions neceſſary to produce ſuch Effects did plainly appear.

HALO, is a reddiſh Spot or Circle of Fleſh which ſurrounds each Nipple in the Breaſts of Women.

HALT, [*Military Term*,] a Pauſe, Reſt, or Stop, in the March of the Soldiery.

HALY-MOTE, (*alias Healge-mote*) a Word retain'd in *Herefordſhire* to this Day for a Court-Warren. It may ſignify a Convention of Citizens in their Court-Hall; or, a Holy or Eccleſiaſtical Court. *Cowel's Interpr.*

HAMBLING, or *Hamelling* of Dogs, is the ſame, in the Laws of the Foreſt, as *Expeditating:* And *Manwood* ſaith, *Canutus*, in *Can.* 1. calls the Lawing of Dogs, *Genuſciſſio*, *Hamſtringing*.

HAMMER. Beſides the *Sledges*, or large *Hammers* uſed by Smiths, there is, 1. The *Hand-Hammer*, which is us'd by the Smith at the Forge with one Hand. Its Edge is call'd the *Pen*; and the other part of the Head the *Face*; and the Hole for the Handle is call'd the *Eye*. 2. The *Rivetting-Hammer*, chiefly us'd for rivetting or ſetting ſtrait cold Iron; or for crooking of ſmall Work; but 'tis ſeldom us'd at the Forge. For the Smith's larger *Hammers*. See *Sledge*.

HAMPER: See *Hanaper*.

HAMSOKEN, *Haimſuken*, *Homeſoken*, is the Term in *Scotland* for the Crime of him that violently aſſaulteth a Man in his own Houſe: And our antient Records call Burglary *Hamſocne*.

HANAPER: See *Clerk of the Hanaper*.

HANCES (in a Ship) are Falls or Deſcents of the Fiſe-Rails, which are placed on Baniſters on the Poop, Quarter-Deck, *&c.* down to the Gangway.

HANCES [in *Architecture*,] are the Ends of elliptical Arches; and theſe are the Arks of ſmaller Circles than the *Scheme* or middle Part of the Arch.

HAND, [in *Painting* and *Sculpture*, &c.] a Term us'd to denote the Manner or Style of this or that Maſter.

HANDBOROW, is a Surety, a manual Pledge; *i. e.* an Inferior Undertaker; as *Headborow* is a Superior or Chief Inſtrument. *Spelman.*

HAND'S-*Breadth*, is us'd for a Meaſure of 3 Inches.

HAND, HANDFUL, } a Meaſure of 4 Inches by the Standard, according to the Statute 33 *H.* 8.

HANDGRITH, was antiently the Word for Peace or Protection given by the King with his own Hand.

HAND-HABEND, is a Thief taken with the Goods in his Hand, or upon him, as we ſay.

HAND-SPIKE, is a wooden Leaver, with which, at Sea, they *Traverſe* the Ordnance, or heave withal in a *Windlaſs* to weigh up the Anchor.

HANGWITE, according to *Raſtal*, was a Liberty granted to a Man whereby he was quit of a Felon or Thief, hang'd without Judgment, or eſcap'd out of Cuſtody.

HANSE, is an old *Gothick* Word, ſignifying a Society of Merchants combin'd together for the good Uſage and ſafe Paſſage of Merchandize from Kingdom to Kingdom. This Society was, and in part is yet, endow'd with many large Privileges of Princes reſpectively within their Territories. It had four principal Seats or States, where the *Almain* or *German* Merchants, being the Erectors of this Society, had an eſpecial Houſe: One of which was here in *London*, and call'd *Gild-Halda Teutonicorum*, or among us vulgarly the *Steel-Yard*, or *Still-Yard*.

HAPPE, from the *French Happer*, to ſnatch or catch, is a Term uſed in our Law: As to *Happe* the Poſſeſſion of a Deed Pole. *Littleton*, Fol. 8. To *Happe* the Rents; as if Partition be made between two Parcenors, and more Land be allow'd to one than to the other: And ſhe that hath moſt of the Land charges it to the other, and ſhe *happeth* a Rent, ſhe ſhall remain an Aſſize without Specialty. *Cowel.*

HARDNESS, is that Quality in Bodies, by which their Parts cohere firmly together, ſo as to reſiſt the Touch; in which Senſe it coincides with what is call'd *Firmneſs* or *Solidity*, in Oppoſition to *Fluidity*.

In ſtrictneſs of ſpeaking, a Body is ſaid to be *hard*, when the Parts of it cohere mutually, ſo as not to yield inwards, or give way to any external Preſſure or Impulſe; and ſo that the Particles are not ſubject to any Motion in regard to each other, without breaking the Body. In this Senſe, *Hardneſs* is the oppoſite to Softneſs, whoſe Parts do readily give way.

HARDNESS, according to the *Peripateticks*, is a ſecondary Quality, upon a Suppoſition that ariſes from *Dryneſs*, which is a primary one, and that it is in proportion thereto.

They ſuppoſe the remote Cauſes of it to be either Heat or Cold, according to the Diverſity of the Subject; for that Heat produces *Dryneſs*, and by that means *Hardneſs* in Clay, and Coldneſs doth the like in Wax.

The *Epicurean* and *Corpuſcular* Philoſophers account for *Hardneſs* from the Figure of its component Parts, and their Union together. — And accordingly it is by ſome aſcrib'd to Atoms, or Particles of Body that are hooked, which mutually catch and hang upon one another.

Again, the *Carteſians* ſuppoſe the *Coheſion* of hard Bodies to be effected by Reſt; *i. e.* by nothing at all.

Sir *Iſaac Newton* ſhews that the primary Particles of all Bodies, whether ſolid or fluid, are *hard*, perfectly hard, and uncapable of being broke by any Power in Nature.

He maintains that theſe Particles are connected together by an attractive Power, and that the Body is either *hard* or ſoft, or even fluid, according to the Circumſtances of this Attraction.

If the Particles are ſo diſpos'd, or fitted for each other, as to touch in large Surfaces, ſuch Body will be *hard*; and the harder as thoſe Surfaces are larger. And, on the contrary, if they only touch in ſmall Surfaces, the Body will remain ſoft by the Weakneſs of the Attraction.

HARDENING *Iron*, *Steel*, *&c.* is the Act or Art of communicating a greater Degree of Hardneſs than they really have: For the effecting which there are divers Methods; as, by hammering them, quenching them when hot in cold Water. *Engliſh* and *Flemiſh Steel* have a pretty high Heat given them to harden them, after which they are preſently plung'd into Water to make them very hard: But *Spaniſh* and *Venice* Steel require only a Blood red Heat, before they are quenched.

Sometimes the Steel is rubb'd with a woollen Rag, dipt in a Mixture of Ground Indigo and Sallad Oil, while it is heating, and afterwards let cool of it ſelf.

Caſe HARDENING is perform'd after the following manner: They take Cow-Horn or Hoof, well dry'd in an Oven, and reduc'd to a Powder; then equal Quantities of this Powder, and Bay Salt, is well mixt with ſtale Urine, or white Wine Vinegar, and the Iron or Steel is covered over with this Compoſition, wrapt up in Loam or Plate Iron, ſo that the Compoſition touch every part of the Work: This is put on the Fire, and the Coals blown to it, 'till the whole Lump has juſt attain'd a Blood red Heat, and no higher; after which it is ſuddenly quench'd in Water.

HARIOT, or *Heriot*, [in *Law*,] is taken for the beſt Cattle that a Tenant hath at the Hour of his Death, due to the Lord by Cuſtom. And there is *Hariot Service* and *Hariot Cuſtom*. *Hariot Service* is after the Death of a Tenant in Fee-ſimple; and *Hariot Cuſtom* is after the Death of a Tenant for Life. Alſo *Hariot Service* is often expreſs'd in the Grant of a Man, that he holds by ſuch Service to pay *Hariot* at the Time of his Death, that holdeth in Fee-ſimple. *Hariot Cuſtom* is when *Hariots* have been paid Time out of Mind by Cuſtom, and this may be after the Death of a Tenant for Life: And for this the Lord may diſtrain and ſeize: But of right, neither the Lord nor Officer ſhould take *Hariot*, before it be preſented at the next Court holden after the Tenant is dead, that ſuch a Beaſt is due for a *Hariot*. If the Lord purchaſe part of the Tenancy, *Hariot Service* is extinguiſh'd; but it is not ſo in *Hariot Cuſtom*. And if the Lord ought to have a *Hariot* when his Tenant dieth, and the Tenant deviſeth away all the Goods, yet the Lord ſhall have the *Hariot*; for the Law preferreth the Cuſtom before the Deviſe.

HARMONIÆ, is, in ſome Authors, an Anatomical Term, and ſignifies the ſame with *Mendoſa Sutura*, *viz.* a jointing together the Bones of the Head, particularly thoſe of the Noſe and Palate, by a ſtrait Line. *L.*

HARMONICA, } ['Αρμονικη, Gr.] a Branch
HARMONICKS, } or Diviſion of the antient Muſick. It is that Part which conſiders the Differences and Proportion of Sounds, with reſpect to *Acute* and *Grave*, in Contradiſtinction to *Rhythmica* and *Metrica*.

HARMONICAL *Arithmetick*, is ſo much of the Theory and Doctrine of Numbers, as relates to making the Compariſons, Reductions, *&c.* of muſical Intervals, which are expreſs'd by Numbers, in order to the finding the mutual Relations, Compoſitions, and Reſolutions.

HARMONICAL *Compoſition*, in the General Sence, includes the Compoſition both of *Harmony* and *Melody*; i. e. of Muſick or Songs, both in a ſingle Part and in ſeveral Parts. In a more limited or proper Senſe, Harmonical Compoſition is reſtrain'd to that of *Harmony*: In which Senſe it may be defin'd the Art of diſpoſing and concerting ſeveral ſingle Parts together in ſuch a manner as to make one agreeable Whole.

HARMONICAL *Hand*, [in *Muſick*,] a Term ſome Writers uſe for the antient *Diagramma*, or Scale of Muſick, upon which they learned to ſing.

HARMONICAL *Interval*, [in *Muſick*,] is an Interval or Difference of two Sounds which are agreeable to the Ear, whether they be in Conſonance or Succeſſion.

HARMONICAL *Proportion*, or *Muſical*, is when, of four Numbers, As the Firſt: Is to the Fourth :: So is the Difference of the Firſt and Second : To the Difference of the Third and Fourth.

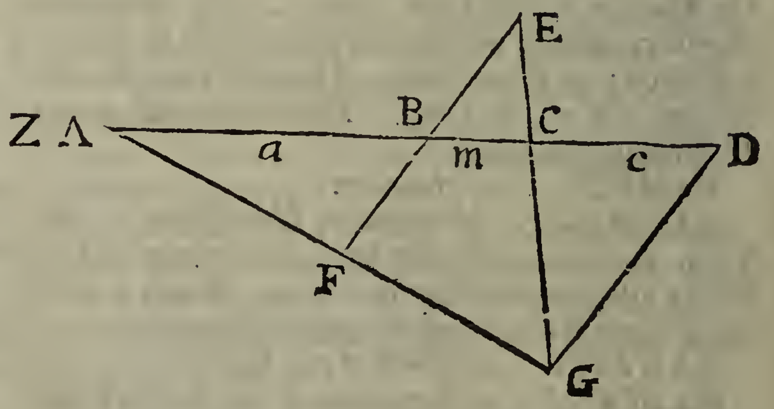
As 5 : 8 : 12 : 30, are *Muſical Proportionals*, becauſe 5 : 30 :: 8 — 5 : 30 — 12 :: 3 : 18.

Suppoſe in *Species* the four Terms A, M, N, E, let it be, $A : E :: M - A : E - N$.

Wherefore $AE - AN = ME - AE$. Theſe Terms being rightly ordered, 'twill be $\frac{AN}{2A - M} = E$; and $\frac{EM}{2E - N} = A$.

In Words thus:

If the Rectangle, contained under the firſt and third Terms, be divided by the Exceſs of twice the firſt above the ſecond; the Quotient will be the fourth Term in *Harmonical* or *Muſical Proportion*: Wherefore it is neceſſary the Terms ſhould be ſo given, that the double of the firſt may exceed the ſecond.



A Right Line, as AD, is ſaid to be divided *Harmonically*, if being cut into 3 Parts, AB, BC, and CD, the Caſe be ſo, that as the Whole AD (or Z:)

is to either Extreme a or c :: ſo ſhall the other Extreme be: to the indeterminate Part m : That is,

$$\left.\begin{array}{l} Z : a :: c : m \\ Z : c :: a : m \end{array}\right\} \text{Wherefore } Zm = ac.$$

And to divide any given Right Line thus *harmonically*, as ſuppoſe AD;

From either End of it draw a Right Line, as DG, making an Angle with it, and of any Length: Connect the End of this Line with the other End A, by drawing AG; and then taking any Point, as B, at pleaſure, in the given Line there draw EF parallel to DG, and in it take BE equal to BF; then draw EG, and that ſhall find the Point C required; and then calling, as above, the whole Line $Z : AB = a : BC = m$, and $CD = C$: I ſay $Z : a :: c : m$.

For the Triangles ADG, ABF, and BEC are all ſimilar; and conſequently $AD : AB :: DG : BF ::$ or as DG : to $BF = BE$; but as $DG : BE :: CD : BC$; (by working about the equal Angles D and EBC:) Wherefore, by Equality, $AD : AB :: CD : CB$; that is, $Z : a :: c : m$. *Q. E. D.*

And from hence 'tis plain, That the *Ratio* of the whole Line AD to the Segment B, may be taken at pleaſure: But that the intermediate Part BC, muſt be leſs than either AB or CD.

HARMONICAL *Series*, is a Series of many Numbers in continual harmonical Proportion. If there are 4 or more Numbers, of which every 3 immediate Terms are *harmonical*, the whole will make an *harmonical Series*, of continual harmonical Proportion: As 30 : 20 : 15 :: 12 : 10. Or if every 4 immediately next each other are harmonical, it is alſo a continual *harmonical Series*; but of another Species; as 3, 4, 6, 9, 18, 36, *&c.*

HARMONICAL *Sounds*, are ſuch Sounds as always make a certain determinate number of Vibrations, in the time that ſome other fundamental Sound to which they are referr'd, makes one Vibration.

Harmonical Sounds are produced by the Parts of Chords, *&c.* which vibrate a certain number of times, while the whole Chord vibrates once; and by this they are diſtinguiſhed from the third, fifth, *&c.* where the Relation of the Vibrations is 4 to 5, or 5 to 6, or 2 to 3.

The Relation of Sounds had before been conſidered only in the Series of Numbers, 1 : 2, 2 : 3, 3 : 4, 4 : 5, *&c.* which produc'd the Intervals call'd *Octave*, *Fifth*, *Fourth*, *Third*, &c. 'till Mr. *Sauveur* conſidered them in the natural Series 1, 2, 3, 4, *&c.* and examined the Relations ariſing from thence. The Reſult is, that the firſt Interval, 1 : 2, is an *Octave*; the ſecond, 1 : 3, a *Twelfth*; the third, 1 : 4, a *Fifteenth*, or *double Octave*; the fourth, 1 : 5, a *Seventeenth*; the fifth, 1 : 6, a *Nineteenth*, &c. Which new Conſideration of the Relations of *Sounds*, is more natural than the old one.

HARMONY, is an agreeable or pleaſing Union between two or more Sounds, continuing together at the ſame time.

Harmony is naturally produced by *Conſonances*, but Art hath diſcover'd the way to make it yet more agreeable, by the Mixture of *Diſſonances*.

HARMONY. Dr. *Holder* in his Diſcourſe on this Subject, ſaith, That when the ſonorous Body is conſtituted of Parts ſolid or tenſe, regular and fit to receive and expreſs the tremulous Motion of Sound, equally and ſwiftly, it will then render a certain even *harmonical Tone* or *Tune*.

The Tune of any Note is conſtituted by the Meaſure and Proportion of the Vibrations of the ſonorous Body; *i. e.* of the Velocity of thoſe Vibrations in their Recourſes.

For the more frequent the Vibrations are, the acuter will be the Tune; and the ſlower or fewer they are in *the ſame Time*, the graver is the Tune.

So that *any given Note of a Tune is made by one certain Meaſure of Velocity of Vibration*, *viz.* Such a certain Number of *Courſes* and *Recourſes* (*i. e.* forward or backward Vibrations) of any Chord or String in ſuch a certain Space of Time, doth conſtitute ſuch a determinate Tune: And all ſuch Sounds as are *Uniſons*, let them come from *Voice*, *Bell*, *Pipe*, or *String*, are made with Vibrations all equal to one another.

The Continuance alſo of the Sound in the *ſame Tune*, *to the End*, (as in Strings of Wire, which being once ſtruck will hold their Sound long in the ſame Note) depends upon the Equality of Time of the Vibrations from the greateſt Range till they come to ceaſe: As is the known Property of *Pendulums*: And a muſical String ſtruck, is like a double *Pendulum*, moving upon two Centres, the *Nut* and the *Bridge*, and vibrating with its greateſt Range in the middle of its Length, and the Vibrations equal, even to the laſt; which muſt make it keep the ſame Tune as long as it ſounds. And becauſe it doth plainly keep the ſame Tune to the laſt, the Vibrations are equal.

The Meaſures of Swiftneſs of Vibrations of the String or Chord, as hath been ſaid above, conſtitutes and determines the Tune, as to the *Acuteneſs* and *Graveneſs* of the *Note* which it ſounds: and the lengthning or ſhortning of the String under the ſame Tenſion, determines the Meaſure of the Vibrations which it makes. And thus *Harmony* comes under mathematical Calculations of Proportions; as to the Length of the Chords, the Meaſure of the Time in Vibrations, and of the Interval of tuned Sounds. As the Length of one String is to another, (if of the ſame Matter, Thickneſs and Tenſion) ſo is the Meaſure of the Time of their Vibrations. As the Time of the Vibration of one String to another, ſo is the *Interval* or Space of *Acuteneſs* or *Graveneſs* of the Tune of that one, to the Tune of the other: and conſequently, as the Length is, ſo is the determinate Time, *cæteris paribus.* Theſe Vibrations impreſs a Motion of Undulation or Trembling in the Air, as far as the Motion extends, of the ſame Meaſure with the Vibrations.

And if the Motions made by different Chords are ſo commenſurate that they mix and unite, and bear the ſame Courſe altogether, alternately or frequently: Then the Sounds of theſe different Chords, thus mixing, will calmly paſs the *Medium*, and arrive at the Ear as *one Sound*, or nearly the ſame; and ſo do evenly, ſmoothly, and with pleaſure ſtrike the Ear; which produces what they call a *Conſonancy*; and from the want of ſuch an agreeable Mixture, *Diſſonances* do ariſe.

And as the more frequent Mixture or Coincidence of Vibrations render the *Concords* generally ſo much the more perfect; ſo the leſs there is of Mixture, the greater and more harſh will the *Diſcord* be.

From all which 'tis eaſy to ſee the Reaſon why Concords are agreeable and pleaſing to the Ear; which is becauſe they unite in their Motions often; at leaſt in every ſixth Courſe of Vibration; as is apparent from the muſical *Ratio's* by which they are conſtituted, which are all contain'd within that Number of 6.

Thus the agreement between two or more *Uniſons*, or Chords, of the ſame length, *&c.* is becauſe the Vibrations of ſuch Sounds are equal to *Time* and *Meaſure*, and do join and unite in every *Courſe* and *Recourſe.*

If the String *A* be double in length to *B* (I proceed according to the uſual Diviſion of the Monochord) *i.e.* as 2 to 1. Then the Vibrations of *B* will be duple to thoſe of *A*, or twice as ſwift: and conſequently if theſe Strings are ſtruck together, their Vibrations will unite alternately; *viz.* at every *Courſe* croſſing at the Recourſe, and give the Sound of the *Octave* to one another.

If the Length of *A* to that of *B*, be as 3 to 2: Then reciprocally their Vibrations will be as 2 to 3; and their Sounds will *concord* in a *Fifth*; their Motions uniting after every ſecond *Recourſe*; *i. e.* at every other, or third Courſe.

If *A* be to *B*, as 4 to 3, they ſound a *Fourth* together, and their Vibrations unite after every third Recourſe, or at every fourth Courſe.

If the Length of *A* be to that of *B*, as 5 to 4, they ſound a *Ditone* or *Third Major*; and their Motions unite after every fourth Recourſe, or at every fifth Courſe.

If *A* be to *B*, as 6 to 5, then they ſound a *Trihemitone* or *Third Minor*; uniting their Vibrations after every fifth Recourſe, and at every ſixth Courſe, *&c.*

And thus by the frequency of their being mix'd and united, the *Harmony* of join'd Concords in Muſick is found ſo very ſweet and pleaſing; the Remoter being alſo combined by their Relation to other Concords beſides the *Uniſon.* The *ſixth Major*, which is 5 to 3, is within the Compaſs of *Ratio's* between 1 and 6. But the *leſſer Sixth* (8 to 5) is beyond it; but is the Complement of 6 to 5, to an *Octave*; and makes a better Concord by its Combinations with the *Octave* and *Fourth* from the *Uniſon*; having the Relation of a *third Minor* to one, and of a *third Major* to the other, and their Vibrations uniting accordingly. The *ſixth Major* hath the ſame Advantage.

HARO, *Harron*, is an *Outcry*, or a Hue-and-Cry after Felons and Malefactors: See the Original of this Cuſtom *de Haro* among the *Normans*, *in La Couſtume de Normandie par Mr. H. Baſnage*, Vol. 1. p. 104. Perhaps, hence our *Engliſh* Word to be *Har'd*, *i. e.* frighted, and *haraſs'd*, tired, *&c.*

HARPINGS, in a *Ship*, is properly her Breadth at the Bow; tho' ſome call the Ends of the *Bends*, which are faſtened into the Stem, by the ſame Name.

HATCH, a Term in *Mining*: See *Eſſay-Hatch. Hatch* is alſo us'd for a Croſs-Board that lies a-thwart the *Paſs*, to hinder the *Ore* from tumbling all at once into the *Coffer* of a *Stamping-Mill.*

HATCHES of a *Ship*, are the Doors in the Midſhip, or between the Main-maſt and Fore-maſt, by which any Goods of Bulk are let down into the Hold. Hence the

HATCH-*Way*, is that Place which is directly over the Hatches; ſo that to lay a Thing into the *Hatch-way*, is to put it ſo that the Hatches cannot be come at, or opened.

HATCHING, is a Term us'd in the Art of Drawing or Deſigning in Black and White; and by it is underſtood a manner of Shadowing by a continual *Series*, or Succeſſion of many Lines ſhorter or longer; cloſer or more ſeparate; oblique or direct; according as the Work requires, to render it more or leſs enlighten'd.

HAURIANT, the Term in *Heraldry* proper to blazon Fiſhes, when they are born in any Eſcutcheon in an erect or perpendicular Poſture, as if they were putting up their Heads above the Water to breathe.

HAW, is a ſmall Quantity of Land, and uſually ſuch as lies near a Houſe: as a *Hemp-Haw* or Plat, a *Bean-Haw:* and ſome old Manuſcripts ſay that *Haw* is the ſame with *Manſio*, a Dwelling-Houſe, as in *Doomſday-Book*, *&c.*

HAWSER, (or *Halſer*) is a Rope conſiſting of three Strands, being a kind of a little Cable, ſerving for many Uſes on board a Ship, as to faſten the Main and Fore-ſhrouds, to warp a Ship over a Bar, *&c.*

HAWSES, of a *Ship*, are two round Holes under her Head or Beak, through which the Cables paſs when ſhe is at Anchor. They ſay a Ship hath a *Bold Hawſe*, when the Holes are high above Water. A *Freſh Hawſe*, is when there is a Suſpicion that the Cables are fretted in the Holes. To *Freſh the Hawſe*, is to lay new Pieces upon the Cable in the *Hawſe.* They call it *burning in the Hawſe*, when the Cable endures an extraordinary Streſs. *Clearing the Hawſe*, is untwiſting the Cables, which, by reaſon of the Ship's winding, are intangled one with another.

HEAD, [in *Architecture*,] an Ornament of Sculpture or carved Work, frequently ſerving in the Key of an *Arch*, *Plat-Band*, &c.

HEAD-*Angles*: See *Angles.*

HEAD-BOROW, ſignifies him that is Chief of the *Frank-Pledge*, and him that had the principal Government of them within his own *Pledge.* And as he was call'd *Head-Borow*, ſo he was alſo call'd *Burrow-Head*, *Burſholder*, (now *Borſholder*) *Third-Borow*, *Tything-Man*, *Chief-Pledge*, and *Borow-Elder*, according to the diverſity of Speech in divers places. This Officer is now uſually call'd a *Conſtable.*

HEAD *of a Camp* is the Front or foremoſt Part of the Ground an Army is encamped on, or that which advances moſt towards the Campaign, Field, or Enemy.

Dragon's HEAD, [in *Aſtronomy*,] is the deſcending Node of the Moon, or any other Planet.

HEAD of a *Horn-work*, [in *Fortification*,] is that Part which is contain'd between two Demi-Baſtions.

HEAD-*Lines*, in a *Ship*, are the Ropes of all Sails which are next to the Yards, and by which the Sails are made faſt to the Yards.

Moor's HEAD, [with *Engineers*,] a Term us'd for a kind of Bomb or Grenado ſhot out of a Cannon.

Moor's HEAD, [with *Chymiſts*,] a Cover or Capital of an *Alembick*, having a long Neck, to convey the Vapours rais'd by the Fire into a Veſſel; which ſerves as a *Refrigeratory.*

Moor's HEAD, [in *Heraldry*,] a Repreſentation of the Head of a *Black Moor*, commonly in Profile, and ſwath'd or roll'd about with a Bandage; which is often borne as a Creſt.

HEAD *Mould-Shot*, [in *Medicine*,] a Diſeaſe in Children, in which the Sutures of the Skull, generally the Coronal, *ride*, i. e. have their Edges ſhot one over another; and are ſo cloſe lock'd up, *e. g.* as to compreſs the internal Parts, the *Meninges*; or even the Brain it ſelf.

HEAD-*Pence*, or *Head-Silver*, was formerly an Exaction of 40*l.* or more, collected by the Sheriff of *Northumberland* of the Inhabitants of that County every Third and Fourth Years; without any Account made to the King. But by 23 *H.* VI. *c.* 7. this was clearly aboliſh'd for ever.

HEADS, is a Term us'd by Builders for thoſe kind of Tiles which they uſe to lay at the Eaves of a Houſe; being the full breadth of a common Tile, and but half a Tile in length.

HEAD-*Sails*, are thoſe Sails in a Ship which belong to the Fore-maſt and Bolt-ſprit, becauſe they govern the Head of the Ship, and do make it fall off and keep out of the Wind; theſe, in Quarter Winds, are the chief drawing Sails.

HEAD-*Sea*, is when a great Wave, or Billow of the Sea, comes right a-head of a Ship as ſhe is in her Courſe.

HEALING, [in *Architecture*,] the Covering or Roof of a Building.

HEALTH, [in *Medicine*,] is defin'd to be a due Conſtitution or Temperament of the ſeveral Parts of which an Animal is compos'd, both in reſpect of Quantity and Quality; or, as others define it, that State of a Body, in which it is fitted to diſcharge its natural Functions perfectly, eaſily, and durably.

HEARING is defin'd to be the Art or Faculty of receiving Sounds; or it may be defin'd more ſcientifically to be a Senſation, whereby the Mind perceives and gets the Idea of Sounds, from a due Motion impreſs'd on the *Fibrillæ* of the Auditory Nerve, and communicated thence to the Senſory.

The Organ of Hearing is the Ear, and particularly the Auditory Nerve that is diffus'd through it: And the Object of Hearing are certain Motions or Vibrations of the Air.

The Opinions of Authors have been different as to the immediate Organ of Hearing. *Ariſtotle* will have it to be the *Cochlea* and *Tympanum*, in which the Senſe of Hearing are ſeated. *Galen* follows the Opinion of *Ariſtotle*.

But the Moderns, on better grounds, ſuppoſe the Ear and the ſeveral Parts of it, *viz.* Membranes, Canals, Labyrinths, Nerves, *&c.* to be only Means, or Vehicles, for the receiving, modifying, and tranſmitting of the ſonorous Matter to the Brain; which is the Seat of this Senſe. As for Sound, that is in Effect nothing but a certain Refraction or Modulation of the external Air, which being collected by the external Ear, paſſes thro' the *Meatus Auditorius*, and beats upon the *Membrana Tympani*, which moves the four Bones in the *Tympanum*.

That theſe little Bones move the internal Air that is in the *Tympanum* and *Veſtibulum*, in like manner that it is beat by the external Air; which internal Air makes an Impreſſion upon the Auditory Nerve in the Labyrinth and *Cochlea*, according as that is mov'd by the little Bone of the *Tympanum*; ſo that the internal Air makes various Impreſſions upon the Auditory Nerve, which is the immediate Organ of *Hearing*, according to the various Refractions of the external Air; which different Impreſſions make different Sounds.

This is carried ſomething farther by Sir *Iſaac Newton*: He ſuppoſes *Hearing* to be like *Seeing*, performed not immediately by the Vibrations of the Air, but by thoſe of ſome other more ſubtil *Medium*, excited in the Auditory Nerves, by the Tremors of the Air; and that they are propagated thro' the ſolid Capillaments of the Nerve to the Place of Senſation.

The Curious Structure of the Labyrinth and *Cochlea*, ſerve to make the weakeſt Sounds audible: For the whole Organ of Hearing being included in a ſmall Space, the Impreſſion would have been made only on a very ſmall Part of it, had the Auditory Nerve run in a ſtrait Line; and the Strength of the Impreſſion being *cæteris paribus*, always as the Number of Parts upon which the Impreſſion is made, thoſe Sounds which are now low, could not be heard at all.

If, like the *Retina*, the Auditory Nerve had been expanded into a large Web, which had covered or lined ſome wide Cavity, even in this Caſe the Impreſſion of Sounds had been much weaker than they are now: For this large Cavity had given room for the Sounds to dilate; and all Sounds grow weaker as they dilate.

But in the preſent Structure of the Labyrinth and *Cochlea*, both theſe Inconveniences are prevented; the Canals of which, by their winding, contain large Portions of the Auditory Nerve; upon every Point of which, the ſmalleſt Sound being once impreſt, becomes audible; and the Sounds are hindred from dilating by their Narrowneſs; and the Impreſſions which are made upon the Nerves by the firſt Dilatations are ever the ſtrongeſt.

In like manner the Strength of the Impreſſion is increaſed in narrow Canals, by means of the Elaſticity of the Sides of the bony Canal; which receiving the firſt and ſtrongeſt Impulſes of the Air, do reverberate them more ſtrongly upon the Auditory Nerve.

It deſerves Obſervation, that tho' the Air be the uſual matter of Sounds; ſo that if a Bell be rung *in Vacuo* it will not be heard at all, yet moſt other Bodies properly diſpos'd will do the like Office; only ſome more faintly than others.

Thus a Sound may be heard through Water, or even through Earth, of which there are various Inſtances.

HEART: See an anatomical Deſcription of it under the Word *Cor*.

HEART. Authors which have treated about this Muſcle are chiefly *Lower de Corde*, *Bellini de Motu Cordis*, and *Borelli de Motu Animalium*; who accounts that the Force of the Compreſſion of the *Heart* to ſqueeze out the Blood into the Arteries, is equal to that of 3000 Pound weight; and that 350 Pound weight of Blood paſſes thro' the *Heart* every Hour: See Dr. *Keil's Animal Secretion*, p. 88. where you have a good Attempt to eſtimate the Quantity of the Blood in an Human Body, its Velocity, *&c.*

HEAT, one of the Four Primary Qualities, and ſeems to conſiſt only, or at leaſt *chiefly*, in the local Motion of the ſmall Parts of a Body mechanically modified by certain Conditions, of which the principal is the vehement and various Agitations of thoſe ſmall inſenſible Parts.

In which Deſcription it appears, there are theſe Three Conditions neceſſary to produce *Heat*;

1. That the ſmall Parts be vehemently and rapidly agitated, or moved, in a much greater Degree than is neceſſary to produce the Quality we call *Fluidity*.

2. That the *Determinations* of the inſenſible Corpuſcles thus vehemently agitated, be alſo *very various*, ſome moving up, ſome down, ſome to the Right Hand, others to the Left, *&c.* And hence,

though Air and Water are, we find often, very vehemently moved, as in Tempeſts and Cataracts; yet there is no reaſon to expect that they ſhould grow hot upon this Motion, becauſe the *Vehemency* belongs to the progreſſive Motion of the whole Body; and notwithſtanding that, yet the Parts it conſiſts of may not any thing near be ſo much quickned in their Motions, made according to other various Determinations, as to grow ſenſibly hot; but in Bodies very hot or enkindled, the rapid Motion of the inſenſible Parts ſeems to have all manner of Directions, and to be darted round, in a kind of burning Sphere, all manner of ways.

3. 'Tis requiſite alſo, to the Production of Heat, That the thus variouſly and vehemently agitated Particles be alſo ſo ſmall, as, generally ſpeaking, to be ſingly inſenſible: For unleſs they are exceeding fine and ſubtle, they cannot penetrate readily into the Pores of contiguous Bodies, and ſo warm or burn them.

As to the Operation of Heat upon our Senſes, the Reſult of which we often call *Heat*, it is uſually eſtimated by its Relation to the Organs of our Feeling; for we don't eſteem any Body to be hot, unleſs the Motion of its ſmall Parts be violent or briſk enough to increaſe or ſurpaſs that of the Particles of the Object: For if it be more languid in the Object than in the Sentient, we pronounce the Body to be cold; but if it be more violent in the Object than in the Sentient, we ſay the Body is hot; as any one may Experiment by putting his Hand, when cold, into warm Water, for then the Water will appear warm to him; whereas, had his Hand been hot, it would have felt cold.

The Intenſeneſs of *Heat* (as alſo of Light) always is as the Denſity of the Rays or Particles of Fire which occaſion it; and that Denſity is as the Diſtance from the Radiating Point *reciprocally.* See *Quality.*

The Learned and Curious Dr. *Slare*, in *Philoſoph. Tranſact. N.* 213. hath publiſhed ſeveral ſtrange Experiments about the Productions of Flame and Fire, from the bare Mixture of two Liquors *actually cold*; which two Liquors are a Vegetable Oil, (the Kinds of which, proper for this Purpoſe, he there gives you in a Table) and a Compound Spirit of Nitre; which Spirit is made by Diſtillation (in a Retort) of equal Parts of Saltpetre and Oil of Vitriol, in a Sand Furnace with a great Fire.

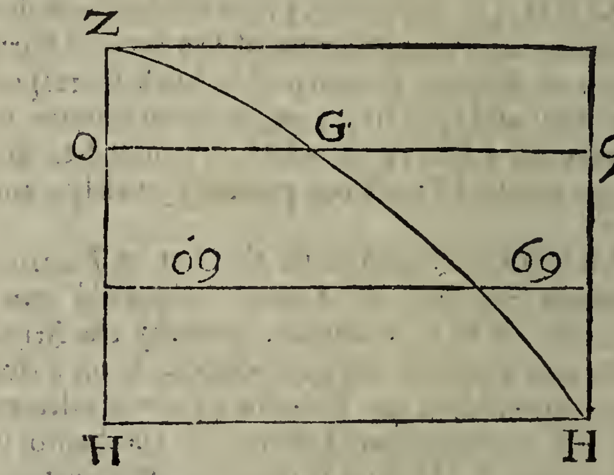
And one thing is very remarkable as to his two Liquors, That tho' Gunpowder cannot be made by firing, to give any Exploſion in the exhauſted Receiver, yet theſe did ſo in a very rapid manner, blowing up the Receiver, and breaking out in a great Flame.

The Learned and Ingenious Captain *Halley* hath a Diſcourſe in *Philoſ. Tranſact. N.* 203. about the proportional Heat of the Sun in all Latitudes, and of a Method for collecting the ſame: Where he ſhews, That the ſimple Action of the Sun is, as all other Impulſes and Strokes, more or leſs forcible, according to the Sines of the Angle of Incidence, to the perpendicular let fall on the Plane, whence the vertical Ray (being that of the greateſt Heat) being put for *Radius*, the Force of the Sun on the horizontal Surface of the Earth, will be to that, as the Sine of the Sun's Altitude at any other Time.

This being allowed for true, it will then follow, That the Time of the continuance of the Sun's ſhining being taken for a Baſis, and the Sines of the Sun's Altitude erected thereon, as Perpendiculars, and a Curve drawn through the Extremities of thoſe Perpendiculars, the *Area* comprehended ſhall be proportionate to the Collection of the Heat of all the Beams of the Sun in that ſpace of Time.

Hence it will follow, That under the Pole the Collection of all the Heat of a Tropical Day, is proportionate to a Rectangle of the Sine of 23 Degrees and a Half into 24 Hours, or the Circumference of a Circle; that is, the Sine of 23 Degrees and a Half, being nearly $\frac{4}{10}$ of Radius, as $\frac{8}{10}$ into 12 Hours. Or the Polar Heat is equal to that of the Sun continuing 12 Hours above the Horizon at 53 Degrees height, than which the Sun is not 5 Hours more elevated under the Equinoctial.

But that this may be the better underſtood, he explains it by the following Figure.



Wherein the *Area* Z G H H, is equal to the *Area* of all Sines of the Sun's *Altitude* under the Equinoctial, erected on the reſpective Hours from Sun-riſe to the Zenith; and the *Area* ♋ H H ♋ is in the ſame Proportion to the Heat for the ſame 6 Hours under the Pole on the Tropical Day; and ⊙ H H Q is proportional to the collected Heat of 12 Hours, or half a Day under the Pole, which Space ⊙ H H Q is viſibly greater than the other *Area* H Z G H, by as much as the *Area* H G Q is greater than the *Area* Z G ⊙; which that it is ſo, is viſible to ſight, by a great Exceſs; and ſo much in Proportion does the Heat of 24 Hours Sun-ſhine under the Pole, exceed that of 12 Hours under the Equinoctial; whence, *cæteris Paribus*, it is reaſonable to conclude, That were the Sun perpetually under the Tropick, the Pole would be at leaſt as warm, as it is now under the Line itſelf.

But whereas the Nature of Heat is to remain in the Subject, after the Cauſe that heated it is removed, and particularly in the Air; under the Equinoctial, the 12 Hours abſence of the Sun does very little ſtill the Motion impreſs'd by the paſt Action of his Rays, wherein Heat conſiſts, before he ariſes again; but under the Pole, the long abſence of the Sun for 6 Months, wherein the Extremity of Cold does obtain, has ſo chill'd the Air, that it is, as it were, frozen, and cannot (before the Sun has got far towards it) be any ways ſenſible of his Preſence, his Beams being obſtructed by thick Clouds, and perpetual Fogs and Miſts, and by that *Atmoſphere* of *Cold*, as the honourable Mr. *Boyle* was pleaſed to term it, proceeding from the everlaſting Ice, which in immenſe Quantities does chill the neighbouring Air, and which the too ſoon Retreat of the Sun does leave unthaw'd, to increaſe again, during the long Winter, that follows this ſhort Interval of Summer.

But the differing Degrees of Heat and Cold in differing Places, depend in a great meaſure upon the Accidents of the neighbourhood of high Mountains, whoſe Height exceedingly chills the Air brought by the Winds over them; and of the Nature of the Soil, which variouſly retains the Heat, particularly the Sands, which in *Africa*, *Arabia*, and generally where ſuch ſandy Deſarts are found, do make the Heat of the Summer incredible to thoſe that have not felt it.

In proſecution of his former Thought, he computed the following Table for every tenth Degree of Latitude, to the Equinoctial and Tropical Sun, by which an Eſtimate may be made of the intermediate Degrees.

Lat.	Sun in ♈. ♎.	Sun in ♋	Sun in ♑
0	20000	18341	18341
11	19696	20290	15834
20	18797	21737	13166
30	17321	22651	10124
40	15321	23048	6944
50	12855	22991	3798
60	10000	22773	1075
70	6840	23543	000
80	3473	24673	000
90	0000	25055	000

Then he gives the following *Corollaries*, very well worth Note.

COROLLARY I.

That the Equinoctial Heat, when the Sun becomes Vertical, is as twice the Square of the Radius; which may be propoſed as a Standard to compare with in all other Caſes.

COROLLARY II.

That under the Equinoctial, the Heat is as the Sine of the Sun's Declination.

COROLLARY III.

That in the Frigid Zones, when the Sun Sets not, the Heat is as the circumference of a Circle into the Sine of the Altitude at 6. And conſequently, that in the ſame Latitude theſe Aggregates of Warmth, are as the Sines of the Sun's Declination; and at the ſame Declination of the Sun, they are as the Sines of the Latitudes, and generally they are as the Sines of the Latitudes into the Sines of the Declination.

COROLLARY IV.

That the Equinoctial Day's Heat, is every where as the Co-ſine of the Latitude.

COROLLARY V.

In all Places where the Sun Sets, the Difference between the Summer and Winter Heats, when the Declinations are contrary, is equal to a Circle into the Sine of the Altitude at 6, in the Summer parallel, and conſequently, thoſe Differences are as the Sines of Latitude into, or multiplied by the Sines of Declination.

COROLLARY VI.

From the foregoing Table it appears, That the Tropical Sun under the Equinoctial, has of all others the leaſt Force: Under the Pole, it is greater than any other Day's Heat whatſoever, being to that of the Equinoctial, as 5 to 4.

From the Table, and theſe Corollaries, a general Idea may be conceiv'd of the Sum of all the Actions of the Sun in the whole Year, and that part of Heat that ariſes ſimply from the Preſence of the Sun, be brought to a *Geometrical Certainty*.

The Heat of the Sun for any ſmall Portion of Time, is always as a Rectangle, contain'd under the Sine of the Angle of Incidence of the Ray producing Heat at that Time.

The Excellent Sir *Iſaac Newton*, at the End of his Opticks, renders it probable, tho' he propoſes it but as a Query, That Flame is a Fume, Vapour, or Exhalation heated red hot; that is, ſo hot as to ſhine: Becauſe Bodies don't flame without emitting a copious Fume, and this Fume burns in the Flame.

The *Ignis Fatuus*, is a Vapour ſhining without Heat, and there ſeems to be the ſame difference between the Vapour and Flame, as between rotten Wood ſhining without Heat, and burning Coals of Fire. In diſtilling hot or ardent Spirits, if the Head of the Still be taken off, the aſcending Vapour will take Fire at the Flame of a Candle, and be turn'd into Flame; and the Flame will run along the Vapour from the Candle to the Still.

Some Bodies heated by Motion or Fermentation, if the Heat grow intenſe, fume copiouſly; and if the Heat be great enough, the Fumes will ſhine and become Flame. Metals in Fuſion uſually don't Flame for want of a copious Sulphur; except Spelter, which fumes copiouſly, and thereby flames.

All flaming Bodies, as old Tallow, Wax, Wood, Foſſil-Coals, Pitch, Sulphur, &c. by flaming waſte and vaniſh into burning Smoke; which Smoke, if the Flame be put out, is very thick and viſible, and ſometimes ſmells ſtrongly, but in the Flame loſes its Smell by burning; and according to the Nature of the Smoke, the Flame is of ſeveral Colours, as that of Sulphur is Blue, that of Copper open'd with Sublimate, Green, that of Tallow, Yellow, &c. Smoke paſſing through Flame cannot but grow red hot, and red hot Smoke can have no other appearance but that of Flame.

As great Bodies probably conſerve their Heat the longeſt, ſo the Reaſon of it ſeems to be, That their Parts heat one another: Whence *great*, *denſe*, and *fix'd Bodies*, when heated beyond ſuch a Degree, may emit Light ſo copiouſly, as by the Emiſſion and Reaction of its Light, and the Reflections and Reactions of its Rays within its Pores to grow ſtill hotter, till it come to ſuch a Period of Heat, as is that of the Sun: Wherefore we may ſuppoſe the Sun and fix'd Stars to be great Earths vehemently hot, whoſe Heat is conſerved by the Greatneſs of the Bodies, and the mutual Action and Reaction between them and the Light which they emit; and whoſe Parts are kept from fuming away, not only by their Fixity, but alſo by the vaſt Weight and Denſity of the Atmoſpheres incumbent upon them, and very ſtrongly preſſing them, and condenſing the Vapours which ariſe from them.

HEAT. Great Bodies are capable of preſerving *Heat* for a long while; their Parts mutually increaſing one another's Heat. And it may be, that a very great denſe and fix'd Body, when heated beyond ſuch a degree, may emit Light ſo copiouſly, that by ſuch Emiſſion, and by the Reaction of its Light, and by the Reflections and Refraction of the Rays within its hidden *Meatus*, it may come to grow ſtill hotter and hotter, as deriving more Degrees of Heat by thoſe ways, than it can of Cold by any other: and by this means it may come to attain a Heat, like that of the Sun: For the Sun and the fix'd Stars ſeem only vaſt Globes of Earth vehemently heated; and whoſe Heat is preſerved by their great Magnitude, and by the mutual Action and Re-action that there is between them and the Light which they emit.

And their Parts are preſerved from evaporating in Flame and Fume, not only by the great Fixity of their Nature, but alſo by the mighty Weight and Denſity of the Atmoſphere which environ them; which preſs them every way with a great *Niſus*, and condenſe their Vapours and Exhalations, whenever they are emitted.

For we ſee that Water, but moderately heated, will boil with Violence when the Preſſure of our Atmoſphere is taken off in the exhauſted Receiver.

And a Mixture of Tin and Lead, being plac'd on a red hot Iron *in Vacuo*, will emit copious Fumes, and even ſome Flame; which yet in our Air will ſcarce viſibly ſmoke. *Vid. Qu.* 11. *Newton Opt.* p. 296. Edit. Lat.

Heat conduces very much to the Fluidity of Bodies, by leſſening the Tenacity of their Parts; for it renders many Bodies fluid, which otherwiſe are not ſo; and increaſes the Fluidity of tenacious Liquors, as of Oil, Balſam, Honey, *&c.* and by the ſame Reaſons leſſens their reſiſting Force: and yet it does not much leſſen the reſiſting Force of Water; which it muſt do, if that Force ariſe chiefly from the *Attrition* or *Tenacity* of its Parts; and conſequently it doth not ariſe from thence, but from the *Vis Inertiæ Materiæ*.

HEAVE, at *Sea*, ſignifies to throw away, or to fling any thing over-board, this they call, *Heaving it over-board*; alſo turning out the Capſtan, is called, *Heaving at the Capſtan*; likewiſe when a Ship being at Anchor, riſeth and falleth by the force of the Waves, ſhe is ſaid, *To Heave and Set.*

To HEAVE *a Flag aboard* [*Sea Phraſe*] is to hang it out.

To HEAVE *out the Topſails* [*Sea Phraſe*] is to put them abroad.

HEAULME, (or as they write it, *Heawme*,) is the Herald's Term for an Helmet, or Head-piece.

HEAVY *Bodies Deſcent*: See *Deſcent of heavy Bodies.*

HEBBER-THEF, was formerly the Privilege of having the Goods of a Thief, and the Trial of him within ſuch a Liberty.

HEBDOMADIUS, was formerly that Canon or Prebendary in a Cathedral Church, which had the peculiar Care of the Choir, and the Officers of it, for his own Week.

HEBRAISM, is the proper Idiom of the *Hebrew* Tongue.

HECTICA [of ἕξις, Gr. Habit,] is a continued Fever, ariſing from the very Habit of the Body, and introduced in a long Time, and has ſo rooted it ſelf into the very Conſtitution, that it is very difficult ever to cure it: For the moſt part it is accompanied with an Ulcer of the Lungs, Leanneſs, and a Cough. *Blanchard.*

HEDAGIUM, from *Heda*, a Hythe, Port or Wharf; was formerly the Term for the Toll or Cuſtom paid at the Hythe or Wharf, *&c.* for landing Merchandize, Goods, *&c.* From which Toll or Cuſtomary Duties, Exemptions were ſometimes granted by the Sovereign to ſome particular Perſons and Societies.

HEEL, that part of the Foot of any Maſt which is pared away ſlanting on the aftward-ſide of the Foot, in order that the Maſt may be *ſtayed afterward on*, the Seamen call the *Heel of the Maſt*; but the *Heels of the Top-maſts* are Squares, and in that they put the Fid of the Top-maſt.

Alſo if a Ship lie on one ſide, whether ſhe be *a-ground* or *a-float*, they ſay, *She heels offward*, or to the Shore, *a-ſtarboard*, or *a-port*.

HEGEMONICÆ, [ἡγεμονικαὶ, Gr.] are the principal Actions in a human Body as the Actions *Animal* and *Vital*. *Blanchard.*

HEGIRA, a Term in *Chronology*, ſignifying the *Epocha*, or *Account of Time* uſed by the *Arabians* and *Turks*, who begin their Computation from the Day that *Mahomet* was forced to make his Eſcape from the City of *Mecca*, which happen'd on *Friday*, *July* 16. *A. D.* 622. under the Reign of the Emperor *Heracleus*.

HEIGHT is the third dimenſion of a Body, in reſpect to its elevation above the Ground.

HEIGHT, or *Altitude* of the Eye in Perſpective, is its Height or Elevation above the horizontal Plane; and it is meaſured by a Perpendicular let fall from the Eye to that Plane.

HEIGHT *of a Figure*, is the perpendicular Line drawn from the Top to the Baſe, (ſometimes produced) either within the Figure or without it.

HEIGHT *of the Pole*: See *Altitude of the Pole.*

HEIGHTS [in the *Military Art*] are the Eminences round a fortified Place, on which Armies uſually poſt themſelves at a Siege.

HEIR, a Word having not altogether the ſame Signification with *Civilians*; who call *Hæredem*, *qui ex teſtamento ſuccedit in univerſum jus Teſtatoris*; as in Common Law, which calls him Heir that ſucceeds by Right of Blood in any Man's Lands or Tenements in Fee; for by the Common Law nothing paſſeth *Jure Hæreditatis* but only Fee: Moveables, or Chattles immoveable, are given by Teſtament to whom the Teſtator liſteth, or elſe are at the Diſpoſition of the Ordinary, to be diſtributed as he in Conſcience thinketh meet. Every Heir, having Lands by Deſcent, is bound by the binding Acts of his Anceſtors, if he be named, *Qui ſentit commodum, ſentire debet & Onus.*

HEIR *Apparent* is one on whom the Succeſſion is ſo ſettled that he cannot be ſet aſide, without altering the Laws of Succeſſion.

HEIR *Preſumptive*, the next Relation or Heir at Law to a Perſon who is to inherit from him, *ab inteſtato*, and who it is preſumed will be Heir, nothing but a contrary Diſpoſition in the Teſtator being able to prevent him.

HEIR *Loom* [in *Law Books*,] Terms ſignifying ſuch Houſhold Furniture, as is not inventoried after the Deceaſe of the Owner; but thoſe Things that neceſſarily come to the Heir along with the Houſe, *viz.* Tables, Preſſes, Cup-boards, Bedſteads, *&c.*

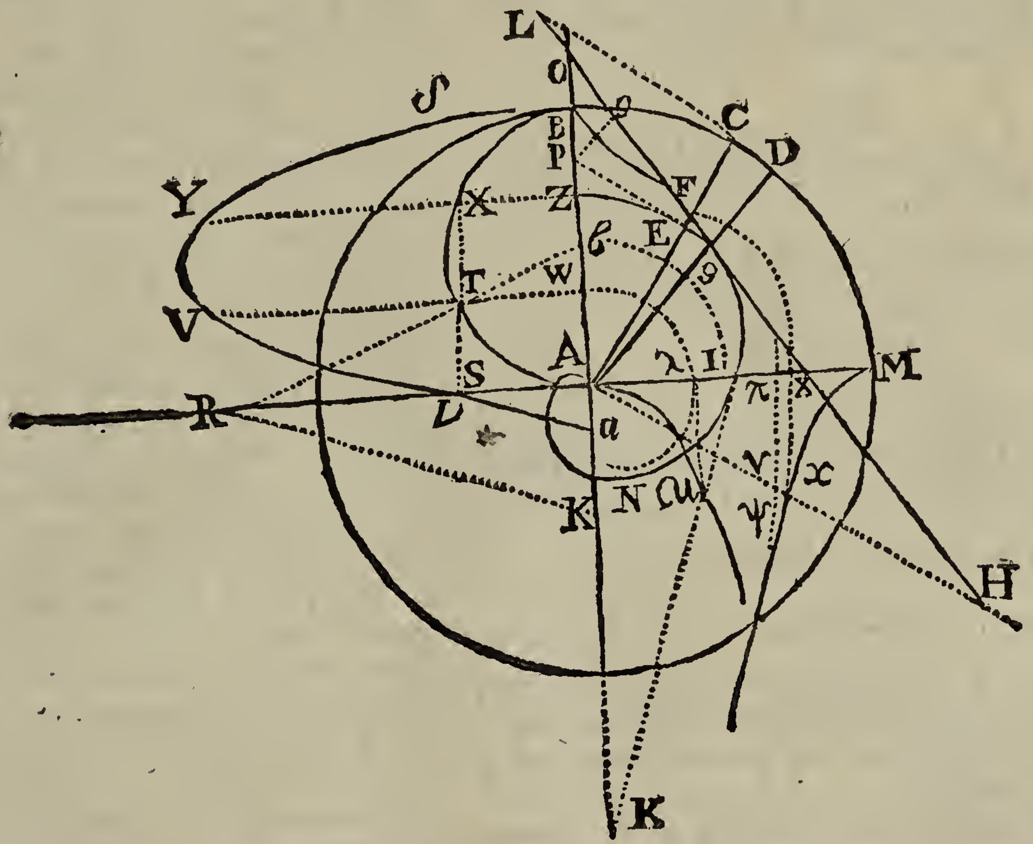
HELCYDRA, [of ʽΕλκύδριον of ἕλκω, Gr. to draw,] are certain little Ulcers, thick and red; and in the Skin of the Head, like the Nipples of the Breaſts, which ſend forth Matter. *Blanchard.*

HELIACAL-*Riſing*, [of ἥλιος, Gr. the Sun,] is when a Star, having been under the Sun's Beams, gets from the ſame ſo as to be ſeen again.

HELIACAL-*Setting*, is when a Star, by the near approach of the Sun, firſt becomes inconſpicuous; this is reckon'd in the Moon but at 17 Degrees Diſtance, or thereabouts; but in other Stars, 'tis as ſoon as they get diſtant, or come near the Sun by the Space of a whole Sine.

HELICE *Major* and *Minor*, the ſame with *Urſa Major* and *Minor*.

HELICOID *Parabola*, or the *Parabolick Spiral*, is a Curve which ariſes from the Suppoſition of the *Axis* of the common *Apollonian Parabola's*, being bent round into the Periphery of a Circle, and is a Line then paſſing through the Extremities of the Ordinates, which do now converge towards the Centre of the ſaid Circle. The *Tangent*, *Area*, *Length*, and *Flexure* of this *Spiral Curve* is inveſtigated by Mr. *J. Bernoulli*, according to the Method of the *Differential Calculus*, in a Diſcourſe on that Method on the *Act. Lipſ.* for *Jan.* 1691. Thus,



Suppoſe the *Axis* of the common *Parabola* to be bent into the Periphery of the Circle *B D M*, (in *Fig.* above;) Then the Curve *B F G N A*, which paſſes through the Extremities of the Ordinates *C F*, *D G*, (which converge towards the Centre of the Circle *A*) is what is called the *Helicoid*, or *Spiral Parabola*, or the *Parabolick Spiral*. And in order to the Inveſtigation of its *Tangent*, *Area*, *Length*, and *Flexure*; He ſuppoſes $AB = r$, $BDMB = c$. The *Arch* $BC = x$, $CF = y$.

Let alſo *C L*, *A H*, be drawn perpendicular to *A C*; and let *C D* be an infinitely ſmall *Arch* on part of the Circumference, ſimilar to, and concentrick with, the little *Arch* *G E*.

The Nature of the Curve is $lx = yy$, (where l ſtands for the Parameter of the Parabola.) Whence, in this *Calculus*, dx being the Fluxion of x, and dy the Fluxion of y, &c. (*See the Marquis l' Hoſpital Analyt. des Infiniment petits.*) $ldx = 2ydy$; and $dy : dx :: l : 2y$.

$Ad : AG :: DC : GE$

Firſt then for the *Tangent*. It will be $r : r-y :: dx : \frac{rdx-ydx}{r}$;

And $\overset{FE}{dy} : \overset{EG}{\frac{rdx-ydx}{r}} :: \overset{FA}{r-y} : \overset{AH}{\frac{dx\times\overline{r-y}^2}{rdy}} :: \overset{FC}{y} : \overset{CL}{\frac{rydx-yydx}{rdy}}$.

To make a particular *Application* of the general Expreſſion to the Curve propoſed; inſtead of dy and dx, ſubſtitute their Proportional l and $2y$; Then will $AH = \frac{2y^3 - ryy + 2rry}{lr} =$ (ſubſtituting lx for yy) $\frac{2xy}{r} + \frac{2ry}{l} - 4x$; and $CL = \frac{2ryy - 2y^3}{lr} = 2x \frac{-2xy}{r}$. The greateſt *A H* (*C L*) will be found, if its Differentials $\frac{6yydy - 8rydy + 2rrdy}{lr}$ (or $\frac{4rydy - 6yydy}{lr}$ the Differentials of *C L*) be put $= 0$: Whence ariſes $y = \frac{1}{3}r$ ($\frac{2}{3}r$;) and conſequently the greateſt $AH\ (CL) = \frac{8rr}{2yl}$ either of them.

COROLLARY.

If the *Parameter* $\frac{l = rr}{c}$, *viz.* that the *Applicate* anſwering to the whole Circumference be the Radius it ſelf, (as in the preſent *Fig.*) then the greateſt *A H* or *C L* will $= \frac{8}{2y}c$.

The greateſt Angle made by the Ordinate and Tangent, viz. *A F H*, or *C F L*, is found, by putting the *Ratio* $\frac{CL}{CF}$, or $\frac{2ry - 2yy}{lr}$ equal a *Maxi-*

Maximum; that is, its *Differential* $\frac{2rdy - yydy}{lr} = 0$. Whence we have $y = \frac{1}{2}r$; and conſequently $\frac{CL}{CF} = \frac{r}{2l}$. But more particularly in the Hypotheſis of $l = \frac{rr}{c}$; we have $x \left(= \frac{yy}{l} = \frac{cyy}{rr}\right) = \frac{1}{4}c$, and $\frac{CL}{CF} = \frac{c}{2r}$.

COROLLARY.

If IK touches the Curve in the Point I (where it interſects the Radius AM) and cuts the Diameter BAK produced in K; then ſhall $AK = \frac{1}{4}$ the Periphery.

Next,

2. *For the Area:* 'Tis $\overline{DC + GE} \times \frac{1}{2}DG = CDGE$: Or, $\frac{2rdx - ydx}{r} \times \frac{1}{2}y = \frac{2rydx - yydx}{2r} =$ (ſubſtituting $\frac{2ydy}{l}$ inſtead of dx) $\frac{2yydy}{l} - \frac{y^3dy}{lr}$. The *Integral* of which is $2\frac{y^3}{3l} - \frac{y^4}{4l3}$, or $\frac{2}{3}xy - \frac{lxx}{4r}$; which is equal to the Curvilineal Space $BFGDCB$. Wherefore putting $y = r$, we ſhall find the whole Space $BANGFBCDMB = \frac{5r^3}{12l}$; that is, in the Caſe of $l = \frac{rr}{c}$ 'tis $= \frac{5}{12}rc$. And ſince the whole Circle $BDMB$ is $= \frac{1}{2}rc = \frac{6}{12}rc$; the aforeſaid Space ſhall be to the Circle as 5 : 6: And therefore the remaining Space $BANGBA$ will $= \frac{1}{6}$ of the Circle.

Again, *Thirdly*, *For the Length of the Curve.* $FG^q = FE^q + EG^q = dy^q + dx^q \times \frac{rr - 2rq - yy}{rr} =$ (ſubſtituting $\frac{2ydy}{l}$, inſtead of dx) $\frac{rrll + 4rryy - 8ry^3 + 4y^4}{rrll}dy^q$.

Hence

$$FG = dy \times \sqrt{\frac{rrll + 4rryy - 8ry^3 + 4y^4}{rrll}};$$

The Integral of which, could it be exhibited, would give the Length of the Curve BFG: Which Rectification may yet be thus expreſs'd. On the Diameter AB deſcribe the Semi-circle $ATXB$, and let $A\alpha$ be cut off $= l$; then drawing any indefinite Perpendiculars WV, ZY, equidiſtant from — A and B, and cutting the Periphery of the Semi-circle in T and X, let the Right Line XTS be drawn, and joining $S\alpha$, take $AK = AS$, and let KR be parallel to $S\alpha$, and the Right Line $R\beta$ be drawn to the Centre of the Semi-circle; equal to which cut off the Right Lines WV, ZY; Then ſhall the Points V, Y, be at the Curve $\gamma VY\delta$; which is of ſuch a Nature, that the *Abſciſſa* $BZ = DG$, and the Space $BZY\delta B$ divided by $A\beta\ (= \frac{1}{2}AB)$ gives a Right Line $=$ the Curve BFG.

Demonſtration.

$AK = AS = WT = ZX = \sqrt{BZ \times ZA} = \sqrt{y \times \overline{r - y}} = \sqrt{ry - yy}$; and $A\alpha\ (= l)$: $AS\ (= \sqrt{ry - yy})$ :: $AK\ (= \sqrt{ry - yy})$: $AR = \frac{ry - yy}{l}$.

Wherefore,

$ZY\ (= WV = R\beta = \sqrt{A\beta^q + AR^q}$ $= \sqrt{\frac{\frac{1}{4}rr + rryy - 2ry^3 + y^4}{ll}}$: Whence a Portion of the Space $Zy\delta B$, of the Breadth $dy = dy\sqrt{\frac{rrll + 4rryy - 8ry^3 + 4y^4}{ll}}$; And this divided by $A\beta = \frac{1}{2}r$, gives $dy\sqrt{\frac{rrll + 4rryy - 8ry^3 + 4y^4}{rrll}} = FG$. And conſequently the whole Space $ZY\delta B$ divided by $\frac{1}{2}r$ is equal to the Portion of the Curve-Line BFG. Q. E. D.

COROLLARY.

Taking BZ, AW, equal to one another; if on the Centre A, and with the Radii AZ, $A\beta$, AW, we deſcribe Arches cutting the Curve in the Points G, I, N, (*Note here, The middle Interſection* I, *in the Caſe of the preſent Figure, falls in the Radius* AM) the Portions of the Curve BG and AN, GI and NI, as alſo BGI and ANI, are equal to one another. Whence 'tis plain, that even thoſe Curves that don't admit of a Rectification, yet ſometimes have *Diſſimilar* Parts equal to one another.

When I had ſignified this to my *Brother*, he preſently obſerv'd, That the Nature of almoſt any *Spiral* being expreſs'd by an *Algebraical* Equation, another *Geometrical* Curve may be aſſign'd equal to it. For on the Centre A, with the Radii AF and AG; deſcribing the Arches $F\rho$, $G\pi$, if the Curve $M\psi$ be imagin'd ſuch, that $\nu\psi$, the Difference of the Ordinates ρx, $\pi\psi$, be equal to the Arch EG: Then, becauſe of $\nu x = \pi\rho = EF$, and $\nu\psi = EG$, and the Angles $\psi\nu x$, FEG, Right ones; alſo ψx ſhall be equal FG; and compounding the whole Portion of the Curve $M\psi$ = the whole Portion of the Spiral BG. Now to find the Nature of the Curve $M\psi$, we need only ſubſtitute (in the Quantity $\frac{rdx - ydx}{r}$, which always expreſſes EG or $\nu\psi$) the Value of dx, which in our Curve is $\frac{2ydy}{l}$; which produces $\frac{2ydy}{l} - \frac{2yydy}{rl}$, the *Integral* of which $\frac{yy}{l} - \frac{2y^3}{3rl}$, gives the Length of the Ordinate $\pi\psi$. Then putting $\pi\psi = z$, we have no Equation between z and $\frac{yy}{l} - \frac{2y^3}{3rl}$, or $3rlz + 2y^3$, or $3rlz + 2y^3 - 3ryy = 0$; which expreſſes the Relation between the *Abſciſſa* $M\pi = y$, and the Ordinate $\pi\psi = z$. But in general, A *Parabolical Spiral*, of any Degree, is by this means tranſmuted into another Geometrical *Paraboloid*, of one Degree higher. This alſo is to be obſerved; That if the Curve $ANIGB$ be the *Archimedean* Spiral, and a common Parabola $A\mu$ be deſcribed at the Centre A, and upon the Axis AK, whoſe Parameter is a fourth Proportional to the Periphery, Diameter, and Radius of the Circle BDM; then ſhall both the Curve Lines, and the Spaces comprehended under them, be equal, *viz.* Taking any Point λ in the Right Line AM; if to this be applied the Right Line $\lambda\mu$, cutting the Parabola in μ, and the Arch λN concentrical to the Periphery of the Circle BM, be drawn cutting the *Spiral* in N; then the Portion of the *Spiral* Line $A\,N$ ſhall ever be equal to the Portion of the *Parabolick* Line $A\,\mu$; and the Space $A\,N$ comprehended between the Right Line $A\,N$ and the *Spiral*, ſhall equal the *Parabolick* Space $A\,\lambda\,\mu\,A$. Which wonderful Agreement of the *Spiral* and *Parabola* we afterwards found Dr. *Willis* had obſerved before; who relates, that *Roberval* and *Hobbs* contended about the firſt Diſcovery of it; as if two Perſons, at a diſtance both in point of Place and Time, might not be led by their own Genius's to one and the ſame Invention.

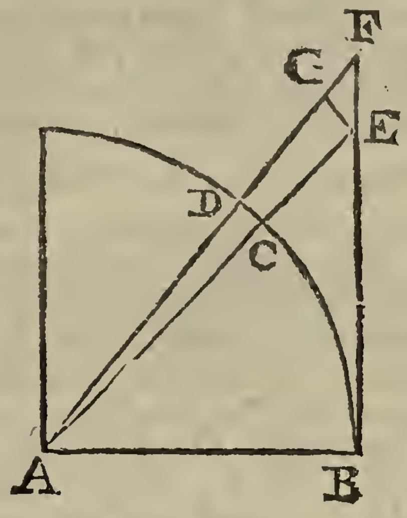
4. *For the Flexure of the Curve.* That the Curve muſt have a Point of contrary Flexion, is evident; for becauſe the Periphery $B\,C$ differs but inſenſibly from a Right Line, for ſome Space beyond the Vertex B, it follows from the Nature of the Parabola, that the Curve muſt be concave towards the Circumference in the Parts next the Vertex, and concave towards the Centre in the reſt. If G, *e. gr.* be the Point of contrary Flexion, then $A\,O$, the Segment of the Radius, intercepted between the Centre and the Tangent, ſhall be a *Minimum*, which put $= M$. Produce $G\,E$ in P, and draw $P\,Q$ parallel to $E\,F$; and let the *Secant* of the Arch $B\,D = s$, and the Tangent $= t$: Then we have the following Proportions; *Viz.* $r : r - y\ (= A\,G) :: t : \frac{t\,r - r\,y}{r}\ (= G\,P) :: s : \frac{s\,r - s\,y}{r}\ (= A\,P.)$

Again, $G\,E : E\,F :: P\,G : P\,Q\ \frac{r\,d\,x - y\,d\,x}{r} : d\,y :: \frac{t\,r - t\,y}{r} : \frac{t\,d\,y}{d\,x}$.

Laſtly; $A\,F : P\,Q :: A\,O : P\,O\ (= A\,O - A\,P)\ r - y : \frac{t\,d\,y}{d\,x} :: M : M - \frac{s\,r - s\,y}{r}$.

Whence we ſhall find,

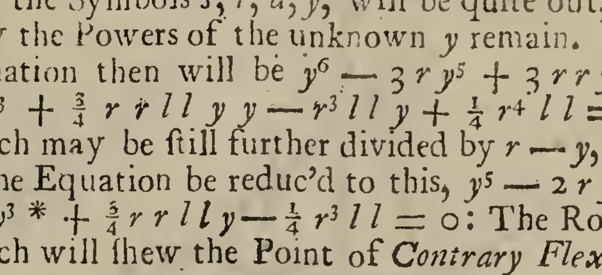
$M = \frac{r\,r\,s\,d\,x - 2\,r\,s\,y\,d\,x + s\,s\,y\,d\,x}{r\,r\,d\,x - r\,y\,d\,x - r\,t\,d\,y}$; and Subſtituting $\frac{l\,d\,x}{2\,y}$ for $d\,y$, and dividing by $d\,x$, we have $M = \frac{2\,r\,r\,s\,y - 4\,r\,s\,y\,y + 2\,s\,y^3}{2\,r\,r\,y - 2\,r\,y\,y - r\,l\,t}$. And therefore the *Differential* of this is to be equal to nothing; but the *Differential* of a Fraction is $= 0$, when its Terms, multiplied into the alternate *Differentials*, are equal: For the *Differential* of the Fraction $\frac{y}{z}$ is $\frac{\mp z\,d\,y \pm y\,d\,z}{z\,z}$; and conſequently if it be $= 0$; then alſo ſhall $\mp z\,d\,y \pm y\,d\,z = 0$; that is, $z\,d\,y = y\,d\,z$. By the help of which Rule we ſhall come to an Equation of ſixteen Members; in order to the Reduction of which, let it be obſerved, *viz.* That the *Differential* of an *Arch* is in a given Ratio to the *Differential* of the *Tangent* and *Secant*; for It is to the *Differential* of the *Tangent*, As the Square of the Radius To the Square of the *Secant*: And It is to the *Differential* of the *Secant*, As the Square of the Radius to the Rectangle under the *Tangent* and *Secant*. For in the Quadrant $A\,B\,D$,



$d\,x : d\,t :: D\,C : E\,F :: D\,C : G\,E + G\,F$; $G\,E + G\,F : E\,F :: A\,D\,(= A\,B) : A\,G + A\,B$; $A\,G + A\,B : A\,F :: A\,B\,q\,(= r\,r) : A\,F\,q\ (= s\,s.)$ Wherefore, $d\,t = \frac{s\,s\,d\,x}{r\,r} =$ (in the preſent Caſe) $\frac{2\,s\,s\,y\,d\,y}{l\,r\,r}$.

Again, $d\,x : d\,s :: D\,C : G\,F :: D\,C : G\,E + E\,F$; $G\,E + G\,F : G\,F :: A\,D\,(= A\,B) : A\,G + A\,B$; $A\,G + A\,B : B\,F :: A\,B\,q\,(= r\,r) : A\,F \times F\,B\ (= s\,t.)$ Wherefore $d\,s = \frac{s\,t\,d\,x}{r\,r} = \frac{2\,s\,t\,y\,d\,y}{l\,r\,r}$: And ſubſtituting theſe Values in the Equation inſtead of $d\,s$ and $d\,t$, as alſo $s\,s - r\,r$ inſtead of $t\,t$, there will come forth another Equation, which may be divided by $s\,t\,d\,y$; ſo that the Symbols s, t, d, y, will be quite out, and only the Powers of the unknown y remain. The Equation then will be $y^6 - 3\,r\,y^5 + 3\,r\,r\,y^4 - r^3\,y^3 + \frac{3}{4}\,r\,r\,l\,l\,y\,y - r^3\,l\,l\,y + \frac{1}{4}\,r^4\,l\,l = 0$; which may be ſtill further divided by $r - y$, and ſo the Equation be reduc'd to this, $y^5 - 2\,r\,y^4 + r\,r\,y^3 * + \frac{3}{4}\,r\,r\,l\,l\,y - \frac{1}{4}\,r^3\,l\,l = 0$: The Root of which will ſhew the Point of *Contrary Flexure*; which in the Caſe of $l = \frac{r\,r}{c}$, is very nearly obtain'd, by drawing the Ray $A\,C$, ſo that the *Applicate* $C\,F$ be $\frac{1}{6}\,r$, or the Arch $B\,C = \frac{1}{26}\,c = 10$ *Gr.*

This Method for finding the Points of *Contrary Flexure* in Curves, ſeeming very tedious, and not ſo natural, in that it makes uſe of Symbols that are ſuperfluous, and do afterwards vaniſh out of the Equation; gave us occaſion to find a ſhorter and eaſier Way for doing the ſame, and that thus: I conceive the Point of *Contrary Flexion* as falling in that Point of the Curve, where two contiguous infinitely ſmall Particles are imagin'd to lie *in directum* with one another: As *ex. gr.* $F\,G$, $F\,I$, the reſt being bent upwards on one hand, and downwards on the other. It follows from hence,

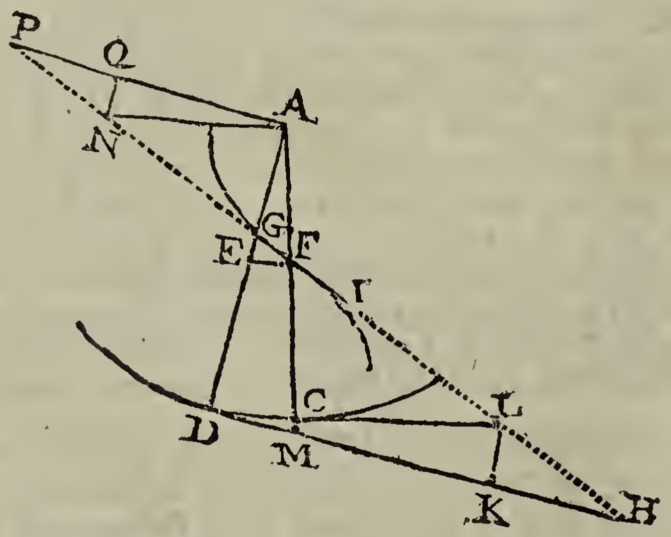


1. That in Curves whoſe Axes are perpendicular, and whoſe Ordinates are parallel to one

another, the acute Angles, EGF, MFI, or DGL, CFL, are *equal*, and either the *greateſt* or the *leaſt* of all thoſe that the Ordinates make with the Curve on the one ſide and the other, according as the Portion of the Curve (that is) at the Parts of theſe Angles, falls either with or without them. From whence the Ratio $\frac{DG}{DL}$ ($= \frac{y}{t}$ is either a *Maximum* or *Minimum*; and conſequently (by what was ſhewn above) $ytd = tdy$. But ſince every where $tdy = ydx$ (*as is evident in all Curves*) therefore ſhall $dt = dx$, *viz.* The *Differential* of the Part of the Axis between the Ordinate and the Tangent, equal to the *Differential* of the *Abſciſſa*: Which is alſo thus manifeſt: Becauſe GF, FI, lie *in directum*, the Tangents GL, FL, ſhall cut the Axis in the ſame Point L; and conſequently, the *Differential* of the *Abſciſſa* DC, will alſo be the Difference of DL and CL.

The celebrated Author of the *Differ. Calculus*, has given another Theorem for this (in the *Acta*,) *viz.* Since the Triangles EGF, MFI, (becauſe of the equal Angles EGF, MFI,) are ſimilar; it follows, That if EF, MI, that is the dx, are equal, alſo EG, MF, or the dy, ſhall be equal too; and conſequently, $ddy = 0$.

2. In the Curves whoſe Applicates tend to ſome common Point or Center A. The Angle $EGF = GAF + GFA = DAC + CFL$: Whence, ſince CL is the Tangent of the Angle CFL to the Radius CF, and DH the Tangent of the Angle DGH to the Radius DG, the Difference of the Right Lines, CL, DH, ſhall be equal to the Difference of the Tangents of the two Angles, that differ by the Angle DAC; one of which is to the Radius CF, and the other to the Radius DG. For tho' the Difference of the Radii EG vaniſhes in compariſon of the *whole Radius or Tangent*; yet 'tis not to be neglected, if compared with their *Differences*.



Let $AC = r$; $DC = dx$; $CF = y$; $CL = t$; and conſequently, $FL = \sqrt{yy + tt}$. Alſo, Let it be AC $(= r)$: DC $(= dx)$ :: CF $(= y)$: $= \frac{ydx}{r}$ an Arch, that is the Meaſure of the Angle DAC, with the Radius CF. This Arch (by *Sect.* 4.) Is to the Difference of the Tangents, in the Duplicate Ratio of the Radius to the Secant. Wherefore FC^q $(= yy)$: FLq $(= yy + tt)$ :: The Arch found $\frac{ydx}{r} : \frac{yydx + ttdx}{ry} =$ the Difference of two Tangents, each to the Radius CF. To which if we add $EF = \frac{rdx - ydx}{r}$ (which Is to EG, As DH To DG, or CL to CF, or Tangent to Radius) the Aggregate will be $\frac{rydx + ttdx}{ry}$, or $dx + \frac{ttdx}{ry}$, the Difference of two Tangents, the one of which agrees to the Radius DG, that is the Difference of the Right Lines CL, DH $(= t;)$ and therefore $dt = dx + \frac{ttdx}{ry}$.

The ſame is more clearly ſhewn thus. On the Centre C, with the Radius CL, deſcribe the Arch LK: For then the Angle $ACL + LCK = AMH = ADM + DAC = ACL + DAC$, and ſo $LCK = DAC$. (*Note, That* CM *is neglected here, and the Points* C *and* M *eſteem'd as co-incident; ſince* CM *is infinitely leſs than the Differentials* DC, LK, EG, *which are infinitely ſmall themſelves.*) Whence, AC $(= r)$: CD $(= dx)$ :: CL $(= t)$: $\frac{tdx}{r} = LK$. Again, GD $(= y)$: DH $(= t)$ :: LK $(= \frac{tdx}{r}$: $\frac{ttdx}{ry} = KH.)$ Wherefore dt $(= DH - CL = DH - CK = DC + KH =)$ $dx + \frac{ttdx}{ry}$.

COROLLARY.

If r be Infinite; that is, If CA, DA, be parallel, then $\frac{ttdx}{ry}$ will vaniſh, and $dt = dx$, as above.

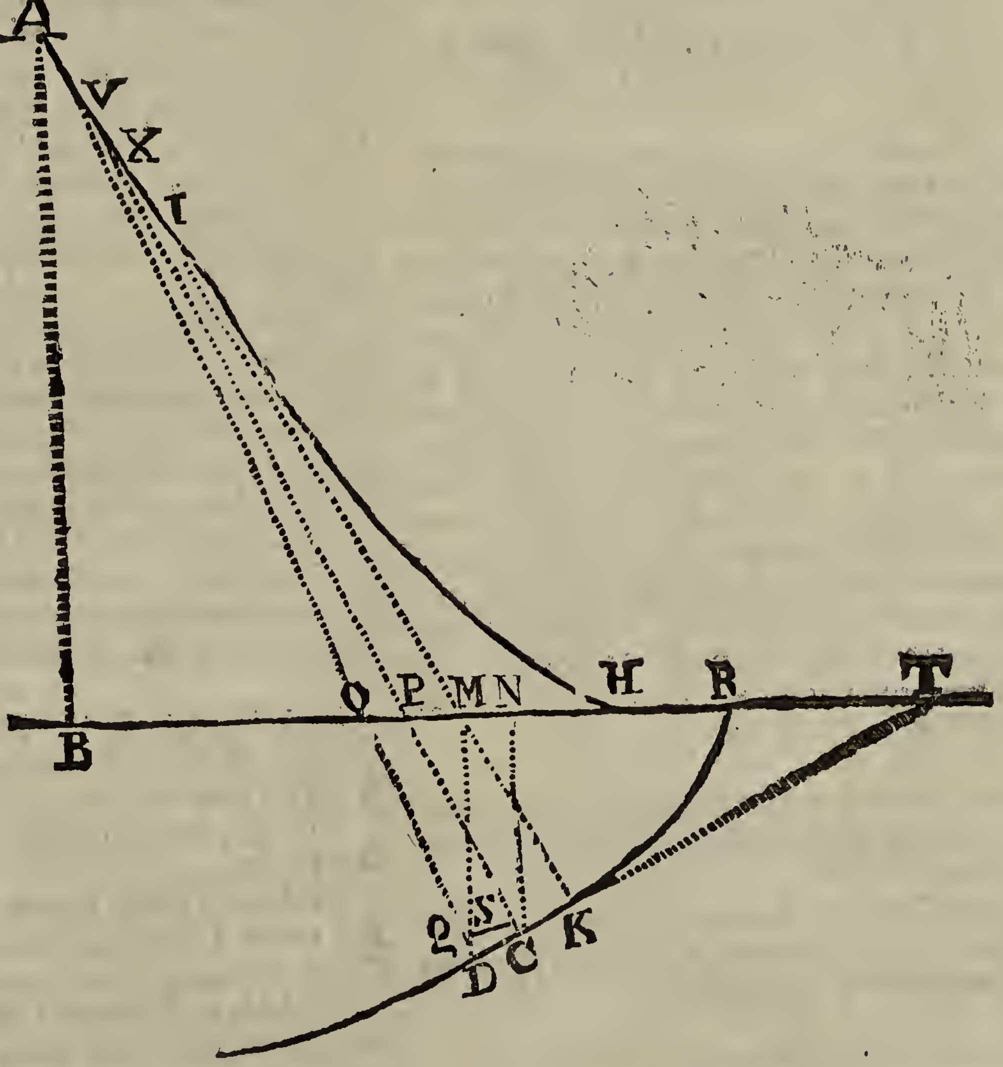
My Brother, inſtead of the Ratio $\frac{GD}{DH}$ or $\frac{GA}{AP}$, aſſumes $\frac{GE}{EF}$, putting $AF = y$, $AP = t$, $EF = dz$; and ſo finds $dt = \frac{dzc}{dyq}$: Which Theorems well deſerve Notice, upon the account of their Univerſality.

For a particular Application of this to the *Parabolick Spiral*: Becauſe CL ($= t$, *Fig. preced.*) was found before $= \frac{2rry - 2y^3}{lr}$, then ſhall $dt = \frac{4rydy - 6ydy}{lr}$; and ſince $dx = \frac{2ydy}{l}$, ſubſtituting the Values of tt, dt, t, dx, and dividing by dy; and reducing the Equation, we ſhall find $y^5 - 2ry^4 + rry^3 * + \frac{3}{4}rrlly - \frac{1}{4}r^3ll = 0$, as before.

5. *The higheſt Point of the Curve* above the Radius BA, is found by making AO (found before) Infinite; *viz.* $\frac{2rrsy - 4rsyy + 2sy^3}{2rry - 2ry - rlt} =$ *Infinito*, or $2rry - 2ryy - rlt = 0$; or inſtead of y ſubſtituting $\sqrt{lx}$, we have $2r\sqrt{lx} - 2lx - lt = 0$: Or in the Caſe of $l = \frac{rr}{c}$, $2\sqrt{cx} - 2x = t$. Which Equation cannot be *Geometrically* reſolv'd, upon the account of the inexplicable Ratio of the Arch to the Tangent. But the Point ſought may be found *Mechanically* near the Truth, thus, by counting 70°. 12'. from B towards M. I Note here, by the By, That it may be demonſtrated from hence, that an *Indefinite Quadrature* of the Circle, and in general the *Rectification* of any *Geometrical Recur-*

rent Curve, is impoſſible: For if this were poſſible, there wou'd be given the Relation between the *Curve* and the *Ordinate* or *Abſciſſa:* And ſince the Relation of theſe to one another, as alſo to the *Tangent*, is ſuppoſed to be given; alſo the Relation of the *Curve* to the *Tangent* would be given too. Wherefore, if the Equation that expreſſes this Relation, be duly compared with the other $2\sqrt{cx} - 2x = t$, according to the Laws of *Algebra*, in order to fling out one of the Indeterminates, x or t: There wou'd then come forth another Equation of a *certain* and *definite Degree*; the Roots of which (which can never be more than the Equation has *Dimenſions*) wou'd determine all the higheſt Points of our Curve. But this is impoſſible; for this *Spiral*, if it be continued, will wind about the Radius *A B* with an infinite Number of Gyres and Turnings, in each of which there is ſome one *higheſt* Point; and therefore the Number of thoſe Points is Infinite.

6. *Of the Evolution of Curves.* If *D C* be the Periphery of a Circle, then all the *Normals*, *D A*, *C A*, *K A*, &c. will meet in one common Point *A*, (the *Centre*) and will each of them be equal to a conſtant Right Line (the *Radius.*) But if *D C* be any other Curve, the ſaid Perpendiculars will be indeterminate, and will interſect one another into many different Points, *A*, *V*, *X*, *I*; which all join'd make a new Curve; the Nature of which is now to be inveſtigated.



Let the Curve propoſed be *R C D*, its Axis *R B*, *Abſciſſa's R N*, *R M*, Ordinates *N C*, *M D*, Tangent *D C T*. Let $RN = m$; $CN = p$; $Nt = q$. Whence, $TN : NC :: NC : NP$

$$q : p :: p : \frac{pp}{q} = MO;$$

Alſo, $NC : NP\ (= MO) :: SD : SQ$

$$p : \frac{pp}{q} :: \qquad dp : \frac{pdp}{q}.$$

Farther, $QS + SC = QC$.

$$\frac{pdp}{q} + dm = \frac{pdp + qdm}{q}.$$

Again, $OP = MN + OM - PN = dm +$ the *Differential* of $\frac{pp}{q} = dm \frac{\pm 2pqdp \pm p^2 dq}{qq} = \frac{qqdm \pm 2pqdp \pm ppdq}{qq}$.

Laſtly, $QC - OP : QC ::$

$$ppdq - pqdp : \frac{pdp + qdm}{q} ::$$

$$\frac{\sqrt{ppqq + p^4}}{qq} \overset{CA - PA.}{} \left(= CP = \sqrt{CN^q + NP^q}\right)$$

$$: CA.$$

$$: \frac{pdq + qdm \times \sqrt{pp + qq}}{pdq - pdp}.$$

7. *Application to the Parabola.* If *R C D* be a Parabola, whoſe Parameter $= l$, ſo that $lm = pp$, then $ldm = 2pdp$, and $dm = \frac{2pdp}{l}$. and $q = 2m$. Subſtituting theſe in the Value of *C A*, we ſhall find $CA = \frac{ll + 4pp\sqrt{ll + 4pp}}{2ll}$; that is, ſince $PN = \frac{1}{2}l$, and $PC = \sqrt{\frac{1}{4}ll + pp}$, CA will $= \frac{PC^3}{PN^2}$, that is a Fourth Proportional to *P N* and *P C*.

8. *To find the Nature of the Curve* AVX (*form'd by the Interſections of the Perpendiculars* D A, C A) *with*

with reſpect to the Axis R B. Cut off $RH = \frac{1}{2}l = PN$, and put $HB = y$, and $BA = z$, and then $AB + NC : AC ::$

$$z + p : \frac{ll + 4pp \sqrt{ll + 4pp}}{2ll} ::$$

$$NC : \quad CP;$$

$p : \sqrt{\frac{1}{4}ll + pp}$; and $\frac{Vz}{z}$ will $= 2p^3$.

Again, $NC : AB :: PN : PB$;

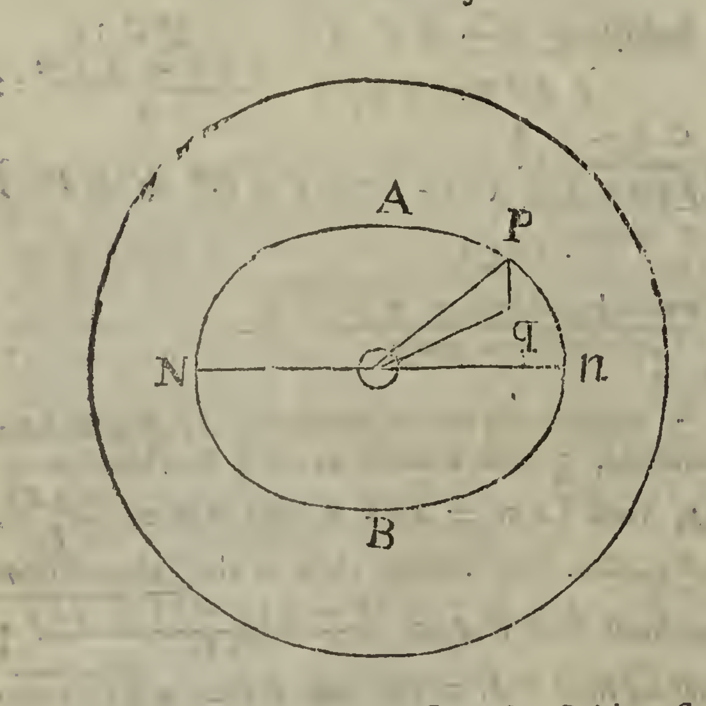
$p : z :: \frac{1}{2}l : \frac{lz}{2p}$; but $y =$ $HB = PB + PH = PB + NR = \frac{lz}{2p} + \frac{pp}{l}$, or $2p^3$ $(= \frac{llz}{2}) = 2ply - llz$; that is, $\frac{3lz}{4y} = p$, and $4p^3$ $(= llz)$ $\frac{27\,l^3z^3}{16\,y^3}$; that is, $16y^3 = 27lzz$.

Farther, Becauſe AD, AC, are perpendicular to the Curve DC, and the Particle DC is infinitely ſmall; therefore ſhall $AD = AC = AV + VC$; but (becauſe of the ſame Reaſon) $VC = VX + XK$, and $XK = XI +$, &c. And therefore $AD = AV + VX + XI$, &c. = Curve $AIH + HR$. And ſince the Curve AIH ariſes from the Interſections of the *Indiſtant* Perpendiculars, DA, CV, KX, it follows, that they are Tangents to it in the ſame Points, and, conſequently, that the Curve RKD is that Curve which is deſcribed by the Evolution of the Curve HIA. From whence are manifeſt, at firſt view, all that *Hugenius* and others have publiſh'd about *Evoluta's*, as alſo the excellent Diſcoveries of *Tſchirnhauſius* and *Leibnitz*, about the Curves formed by the Reflex'd Rays.

HELICOSOPHY [of ἕλιξ ſpiral and σοφία, Gr. Skill,] is the Art of Delineating all ſorts of Spiral Lines *in Plano*.

HELIOCENTRICK *Place of a Planet*, is ſaid to be ſuch, as it would appear to us from the Sun, if our Eye were fix'd in its Centre.

Heliocentrick Latitude of a Planet.



If the outer Circle repreſent the Orbit of the Earth round the Sun, and then the inner one be placed ſo as to be inclined to the Plane of the other (for which reaſon it appears in the form of an Ellipſis) when the Planet is in *N* or *n* (which Points are call'd its *Nodes*) it will appear in the Ecliptick, and ſo have no *Latitude*; but if it move to *P*, then being ſeen by the Sun, it will appear to decline from the Ecliptick, or to have Latitude, and the Inclination of the Line ☉ *P* to the Plane of the Ecliptick, is called the Planet's *Heliocentrick Latitude*, and the Meaſure of it is the Angle *P* ☉ *q*, ſuppoſing the Line *P q* to be perpendicular to the Plane of the Ecliptick: And this *Heliocentrick Latitude* will be continually increaſing till it come to the Point *A*, which they call the *Limit*, or utmoſt Extent of it, and then it will decreaſe again till it come to nothing in *N*; after which it will increaſe again till it come to *B*; and, laſtly, be decreaſing again till the Planet come to be in *n*, &c.

HELIOSCOPES, [Ἡλιοσκόπον of ἥλιος, the Sun, and σκοπέω, Gr. to view] are a ſort of Teleſcopes fitted ſo as to look on the Body of the Sun without offence to the Eyes.

Of theſe Dr. *Hook* hath written a little Tract, and propoſes, that by inſerting four Reflecting Glaſſes into a Teleſcope, the Sun's Rays ſhall come to the Eye, but with $\frac{1}{576}$ part of their uſual Strength. And this Way the Doctor prefers to all others.

But without any ſuch long Apparatus, Mr. *Huygen*'s Way, of only uſing a Plain Glaſs black'd at the Flame of a Lamp or Candle on one Side, and placed between the Eye-Glaſs and the Eye, will anſwer the Deſign of an Helioſcope very well: The Truth of which I have often found my ſelf by Experience.

HELISPHERICAL *Line*, is the Rhumb Line in Navigation; and is ſo call'd becauſe on the Globe it winds round the Pole ſpirally, and ſtill comes nearer and nearer to it, but can't terminate in it.

HELIX, [ἕλιξ, Gr.] is the Exterior Brim of the Ear, ſo called from its winding. The Interior is called *Scapha*.

HELIX, in *Geometry*, is the ſame with *Spiral*: Which ſee.

HELLENISM, is the Imitation in *Latin*, or any other Language, of the proper Idiom of the *Greek* Tongue.

HELM, or Tiller of a Ship, is that Beam or Piece of Timber that is faſtened into the Rudder, and ſo comes forward into the Steerage, where he that ſtands at Helm ſteers the Ship, by holding the Whip-ſtaff in his Hand, a Piece of Wood for that purpoſe, faſtened into the *Helm*.

The Terms of Art belonging to the Helm, are,

1. *Port the Helm*; that is, Put the Helm over to the Left Side of the Ship.
2. *Starboard the Helm*; that is, Put it to the Right Side of the Ship.
3. *Right the Helm*, or *Helm a Mid-ſhip*; that is, Keep it even with the Middle of the Ship.
4. *Bear up the Helm*; that is, Let the Ship go more large before the Wind.
5. *Bear up round*; that is, Let the Ship go directly before the Wind, in the Middle between her two Sheets.

HELM alſo, with the *Chymiſts*, is the Head of any Still or Alembick, becauſe 'tis in Figure ſomething like an Helmet, or Steel Cap, uſed by the Cavalry in War: So that *to bring a thing over the Helm*, is the ſame as to force it by Fire up to the Top of the Veſſel, that it may diſtil down into the Receiver by the Noſe or Beak of the Head; and when they ſay, That ſuch a Thing cannot be brought over the Helm, they mean, 'tis of too fix'd a Nature to be raiſed into Vapour, or Salt, by the Force of Fire.

HELMET, HELM, [in *Heraldry*,] an antient Armour of Defence worn by Cavaliers, either in War, or in Tournaments, as a Cover and Defence of the Head; and is ſtill uſed by way of Creſt or Ornament over a Shield or Coat of Arms. It is ſometimes call'd a Caſk, a Head-piece, a Steel Cap, *&c.*

The Helmet covered the Head and Face, Apperture being left about the Eyes, ſecur'd by Bars, which ſerv'd as a Viſor.

The *Helmet* [in *Armoury*,] is a Mark of Nobility, and the different Degrees of Nobility were indicated by the different Circumſtances of the bearing of the Helmet.

The following Rules for bearing the Helmet, which obtain in *France*, from whence our Heraldry originally came, are as follows.

1. A Perſon which is newly ennobled and made a Gentleman, bears a Helmet of bright Iron or Steel over his Eſcutcheon in Profile or ſtanding ſide-ways, the Viſor being quite cloſe.

2. A *Gentleman* of three Deſcents bears it in Profile, but a little open, ſhewing three Bars of the Viſor.

3. Antient *Knights*, *&c.* bear the Helmet in Profile, but ſhewing five Bars, the edges being of Silver.

4. *Barons* bear their *Helmets* of Silver with edges of Gold, neither quite in Profile, nor yet in Front, ſhewing five Bars, with a Coronet adorn'd with Pearls over it.

5. *Viſcounts* and *Earls*, in antient Times, bore a *Helmet* of Silver, with Gold on the edges, neither quite in Profile nor yet in Front; but now quite Fronting, with a Coronet over it.

6. *Marquiſſes* bear their *Helmet* of Silver damask'd, Fronting, having eleven Bars, with a Marqueſſes Coronet over it.

7. *Dukes* and *Princes* bear their *Helmets* damask'd, Fronting, the Viſor almoſt open and without Bars, with their proper Coronets over them.

8. The *Helmets* of *Kings* and *Princes* are all of Gold, damask'd, full Fronting, the Viſor quite open and without Bars.

9. *Helmets* of *Baſtards* are to be turn'd to the Left, to denote their Baſtardy.

The *Engliſh Heralds* do of late ſomething vary theſe Laws, *Leigh* will have the *Helmet* in Profile and cloſe to belong to *Knights*, tho' all other Authors give it to *Eſquires* and *Gentlemen.*

2. To a *Knight* they aſſign an Helmet ſtanding right forward, and the Bearer a little open.

3. To a *Nobleman* under the condition of a *Duke* they aſcribe a *Helmet* in Profile, or poſited ſide-ways, and open with Bars.

4. To *Dukes*, *Princes*, and *Kings*, they aſſign an Helmet right forward and open with many Bars.

Thoſe *Helmets* that are turn'd ſide-ways ſignifies to be giving Ear to the Commands of Superiors; and thoſe right forwards to be giving Commands with abſolute Authority.

There is ſeldom more than one *Helmet* in a Shield; but if there are two, they muſt be plac'd facing each other; and if there are three, the two on the ſides muſt be looking towards that in the middle.

HELMINTHAGOGUES, [of ἑλμινθος a Worm, and ἄγω, Gr. to lead out,] or *Helminthicks*, are Medicines that expel Worms, or bring 'em away by Stool. *Blanchard.*

HELOS, or *Clavus*, is a round, white, callous Swelling of the Foot like the Head of a Nail, and fixed in the Roots of the hard Skin of the Foot. *Blanchard.*

HEM. The Ovens wherein the *Lapis Calaminaris*, or *Calamine*, is baked, have a Hearth made on one ſide of the Oven, divided from the Oven it ſelf, by a Partition open at the Top, by which the Flame paſſes over, and ſo heats and bakes the *Calamine.* This Partition is called the *Hem.*

HEMERALOPIA, [of ἡμέρα the Day, and ὤψ, Gr. the Eye,] or *Acies nocturna*, is when one ſees better in the Night than in the Day. *Blanchard.*

HEMI [of ἥμισυς, Gr. the half,] is a Word uſed in Compoſition of divers Terms, and ſignifies half; as,

HEMICRANIA, [ἡμικρανία of ἡμι and κρανίον, Gr. the Head,] a *Species* of Head-Ach, or *Cephalalgia*, in which one half of the Head is affected.

HEMICYCLE, [ἡμίκυκλος of ἡμι and κύκλος, Gr. a Cycle] a Semi-circle.

HEMICYCLE [in *Architecture*] a Term apply'd to Vaults in the Cradle-form; and Arches or Frames or Sweeps of Vaults, which conſtitute a perfect Semi-circle.

HEMIOGUS [of ἡμι the half and ὅλος, Gr. the whole] an antient Mathematical Term chiefly to be met with in muſical Writers, and ſignifies the Ratio of two Things, one of which contains the other once and an half, as 3 : 2, or 15 : 10.

HEMIPLEGIA, is a Palſie on one Side below the Head, proceeding from an Obſtruction in one part or other of the ſpinal Marrow; or from a Blow; whence it comes to paſs, that the Animal Spirits are obſtructed in their Paſſage. *Blanchard.*

HEMIPLEXIA, [ἡμιπληξία, Gr.] the ſame with *Hemiplegia.*

HEMISPHERE, [of ἡμι and σφαῖρα, Gr.] is the half of a Globe or Sphere when 'tis ſuppoſed to be cut thro' the Centre in the Plane of one of its greateſt Circles. Thus the Equator divides the Terreſtrial Globe into the Northern and Southern Hemiſphere; and the Equinoctial, the Heavens after the ſame manner.

The Horizon alſo divides the Earth into two Hemiſpheres, the one Light, and the other Dark, according as the Sun is above or below that Circle.

Alſo Maps or Prints of the Heavens, Conſtellations, *&c.* paſted on Boards, are ſometimes called *Hemiſpheres*, but uſually *Planiſpheres.*

The Writers of *Opticks* prove, that a Glaſs Hemiſphere unites the Parallel Rays at the Diſtance of a Diameter and one third of a Diameter from the Pole of a Glaſs. *Molyneux Dioptr. Nov.* p. 94.

HEMISPHEROIDAL [of ἡμι σφαῖρα, and εἶδος, Gr. form,] a Term apply'd by *Geometricians* to ſomething that approaches to the Figure of an Hemiſphere, but is not exactly ſo.

HEMITONE, [in *Muſick*,] was what we now call an *half Note.*

HEMITRITÆUS, [ἡμιτριταῖος, Gr.] an irregular intermitting Fever that returns every Day, but with this Difference from a Quotidian, that the Fit comes twice every other Day.

HENDECAGON, [ἑνδεκαγωνος of ἕνδεκα eleven, and γωνία, Gr. a Corner,] in Geometry, is a Figure that hath eleven Sides, and as many Angles.

HENDECAGON, [in *Fortification*,] is taken for a Place defended by eleven Baſtions.

HENIOCHUS, one of the Northern Conſtellations of fixed Stars: See *Auriga*.

HEPAR, [Ἧπαρ, Gr. the Liver,] is a fleſhy large *Viſcus*, placed in the Right *Hypochondrium*; its Convex and Upper-ſide reaches a little beyond the *Cartilago Xiphoides*, and touches the *Diaphragm*; its Concave and Under-ſide covers the *Pylorus*, and part of the Stomach, as alſo part of the *Colon*; all the *Duodenum*; a part of the *Jejunum*, and of the *Omentum*; and when we are ſtanding, its loweſt Extremity reaches near to the Navel.

Its Figure is almoſt round and pretty thick; its upper Convex-ſide being ſmooth and equal, but the lower Concave one by no means ſo. In its Middle and Fore-part it is divided into two, by a Fiſſure where the Umbilical Veſſels enter. The Gall-Bladder is faſtened to its Under-ſide, where are three Eminences that the Antients called *Portæ*, of which one paſſes for a little Lobe.

When it is full of Blood, it is of a dark red Colour; but when the Blood is waſh'd out of it, it looks pale and feels ſoft.

It is faſten'd to the Body by two Ligaments:

The firſt, which is large and ſtrong, comes from the *Peritonæum* that covers the *Diaphragm*, and penetrating the Subſtance of the Liver, joins the *Capſula* of the *Porta*.

The ſecond is the Umbilical Vein, it comes from the Navel, and enters by the great Fiſſure of the Liver to join the *Porta*: After the Birth it degenerates into a Ligament, but is of little Uſe for the faſtening the Liver: 'Tis covered with a common Membrane from the *Peritonæum*, beſides that every Lobe and Gland has its proper Membrane: The common Membrane of the Liver being raiſed, its Subſtance appears, which is compoſed of ſeveral Lobes of Glands, of a Conick Figure, not eaſily to be diſtinguiſh'd in the Liver of Men: Theſe Lobes are diſpoſed all along the Sides of each Branch of the Veſſels in the Liver, they are every one cover'd with a proper Membrane, and ty'd to one another by other Membranes in ſuch a manner, as that they leave alſo little Intervals betwixt them, which are more viſible in Fiſh, and other imperfect Animals; every Lobe receives ſmall Veſſels, which are continued to the little Glands of which each Lobe is compoſed.

The Veſſels of the Liver, are the *Vena Cava* and the *Porta*; they are accompanied with many ſmall Branches of the Arteries, which come from the *Cæliack* and *Meſenterica Superior*, which two bring the Blood for the Nouriſhment of the Liver: The *Porta* brings the Blood full of Bile for Secretion, and the *Cava* carries back the Blood that remains from both: The *Vena Porta* and the *Cava* enter the Liver by its Concave-ſide, and are equally diſtributed through all its Subſtance: Where-ever there is a Branch of the one, there is a Branch of the other; ſo that each Lobe, and each Gland in the Lobe, whether on the Convex, or on the Concave-ſide, receive the ſame Veſſels.

The *Vena Porta* diſcharges by the Extremity of its Branches the Blood, as yet full of Bile, into the little Glands which form the Lobes, of which the *Parenchyma* of the Liver is compoſed, where being ſeparated from the Bile, which is taken up by the bilary Veſſels (which accompany the Branches of the *Porta*) and carried to the Gall-Bladder or *Duodenum*, it is carried back by the Branches of the *Cava*; it receives its Nerves from the *Plexus Hepaticus* of the intercoſtal Nerve.

Beſides theſe Veſſels, the Liver has Lymphatick Veſſels, moſt of which open into the conglobated Glands, near the *Porta*, on the Concave-ſide of the Liver, from thence the *Lympha* is carried by other Lymphaticks to the *Receptaculum Chyli*.

We come now to the Excretory Veſſels of the Liver; which are, the *Veſicula Fellis*, and *Porus Bilarius*: The *Veſicula Fellis*, or Gall-Bladder, is fixed to the Concave-ſide of the Liver; its Figure is like that of a Pear; 'tis of a different Bigneſs almoſt in every Subject; the biggeſt is about the Bigneſs of a little Hen's Egg; when the Liver is in its natural Situation, the bottom or largeſt Part of the Bladder is downwards, and the Neck or narroweſt Part upwards, and the Point touches the Stomach, as well as the *Colon*, where it frequently dyes them Yellow. This Bladder is compoſed of three Coats, the outermoſt is common to it with the Liver; the next which is proper to it, is thick and ſolid, compoſed of Tranſverſe, Oblique, and Strait Fibres: The third is thin and nervous: This laſt Coat is cover'd within by a kind of Cruſt or Mucus, which preſerves it againſt the Acrimony of the Bile: *Malpighius* has remarked ſome little Glands between its Coats, where the Cyſtick Arteries end; which gave him ground to think that it was the ſame in the *Porus Bilarius*. The Bile is brought into the Gall-Bladder by ſome ſmall Veſſels which ariſe from the neighbouring Glands, and uniting, form one or two Pipes which open at the Neck of the Bladder: Theſe Ducts I could never diſcover in any Liver but an Ox's, though I have reaſon to think they are likewiſe in an Human. From the Neck of the Gall-Bladder there goes a Pipe, not in a ſtrait Line with the Bladder, but as it were more depreſs'd in the Liver; it is called *Ductus Cyſticus*; ſome ſmall Bilary Ducts open likewiſe into it, and its inner Membrane has ſeveral *Rugæ*, which retard the Motion of the Bile. To this Pipe (which is about the Bigneſs of a Gooſe-Quill) is join'd another, called *Ductus Hepaticus*, or *Porus Bilarius*; theſe two together make the *Ductus Communis Choledochus*, which goes obliquely to the lower end of the *Duodenum*, or the beginning of *Jejunum*: After it has pierced the firſt Coat, it runs near two Fingers breadth between the Coats, before it opens the Cavity of the Inteſtine; which oblique Inſertion ſerves inſtead of a Valve, to hinder the Bile to return into *Ductus Communis*, having once enter'd the Inteſtine. The Gall-Bladder has two Veins from the *Porta*, which are called *Cyſticæ Gemellæ*; it has ſome ſmall Arteries from the *Cæliaca Dextra*, and ſome Lymphaticks.

The *Porus Bilarius* is another Excretory Veſſel of the Liver; it has as many Branches as the *Vena Porta*, which it accompanies through every Lobe and Gland in the Liver; where ever there is a Branch of the one, there is a Branch of the other, and theſe two are encloſed in one common Capſule, as in a Sheath: The Uſe of this Capſule is to facilitate the Blood and Bile, by the Contraction of its Fibres. All theſe Branches unite, and make one Pipe of the Bigneſs of a ſmall Quill, which joins, as we have ſaid, at the end of the *Ductus Cyſticus*, for the carrying the Bile from the Liver to the Inteſtines, by the *Ductus Communis Choledochus*.

The Inſertion of the *Porus Bilarius* into the *Ductus Cyſticus*, is Oblique, with its Mouth looking towards the *Ductus Communis*; by which means it is impoſſible that the Bile which comes from the *Cyſtus*, can enter the *Porus*.

The Bile which is found in the Gall-Bladder, is thinner, and different from that which is in the *Porus Bilarius*. This *Malpighius* proves by an Experiment, which is this, That having tied the *Ductus Cyſticus*, he remarked, that the Bile which came by the *Porus Bilarius* was of a different Taſte, Smell, Colour, and Conſiſtency from that in the Gall-Bladder.

The Uſe of the Bile is to ſheath or blunt the Acids of the Chyle; becauſe they being entangled with its Sulphurs, thicken it ſo, as that it cannot be ſufficiently diluted by the *Succus Pancreaticus* to enter the *Lacteal Veſſels*; this appears not only from the Analyſis of the Bile, which yields more of a Lixivious than of a Volatile Alkaline Salt; but likewiſe from what *Lubenhoeck* has obſerved, That of the great Quantity of acid Salts he has ſeen amongſt the Aliments of the Stomach, he never could find any in the Chyle, after it had paſſed the *Duodenum*.

Becauſe ſome Chyle is almoſt always paſſing through the *Duodenum*, therefore it was neceſſary that the Bile likewiſe ſhould be continually poured into it from the *Ductus Hepaticus*. In a Dog, whoſe *Ductus Communis Choledochus* was near as big as in a Man, I have gather'd it at the rate of two Drachms in an Hour; but becauſe a great Quantity of Aliments requires a greater Quantity of Bile, therefore according as the Stomach is more or leſs diſtended with Food, it preſſes out of the Gall-Bladder a proportionable Quantity of Gall, to be mix'd with the Chyle in the Guts. Dr. *Keil*.

HEPATICK *Medicines* are, for the moſt part, ſuch as are both *Diaphoretical* and *Diuretical*.

HEPATICA *Vena*, the ſame with *Baſilica*. L.

HEPATICK *Aloes*, is the fineſt ſort of Aloes, brought commonly from an Iſland in *Perſia*, called *Succotra*, whence the Name *Aloes Succotrina*: 'Tis called *Hepatick*, becauſe 'tis near the Colour of the Liver.

HEPATICUS *Morbus*, or *Hepatick Flux*, is a Dejection, of a watery ſharp Blood, like the waſhing of Fleſh, when the nervous Juice, or watery Blood, being not rightly concocted, but ſharp, is diſcharged into the Guts: Alſo when black ſhining dried Blood is driven into the Guts. The Diſeaſe is ſo called, becauſe they attributed Sanguification to the Liver. *Blanchard*.

HEPATITIS [Ἡπατῖτις, Gr.] an Inflammation of the Liver, with an Abſceſs and Impoſthume of it. It is very like to the *Pleuriſy*; excepting that its Symptoms are not ſo intenſe. It commonly either proves mortal, or diſcuſſes and ſuppurates gradually, or degenerates into a *Schirrus*.

HEPIALA: See *Epiala*.

HEPTACHORD *Verſes*, [of Ἑπτάχορδον of ἑπτὰ ſeven, and χορδὴ, Gr. a String,] ſuch Verſes as were ſung or play'd on ſeven Chords; *i. e.* in ſeven different Notes or Tones; and probably on an Inſtrument of ſeven Strings.

HEPTAGON, [ἑπταγωνα, Gr.] in Geometry, is a Figure of ſeveral Sides and Angles; and is call'd a *Regular Heptagon*, if thoſe Sides and Angles be equal.

HEPTAGON, [in *Fortification*,] is taken for a Place that hath ſeven Baſtions for its Defence.

HEPTAGONAL *Numbers*, [in *Arithmetick*, &c.] are a ſort of Polygonal Numbers; in which the Difference of the Terms of the correſponding arithmetical Progreſſion is 5.

Among other Properties of theſe Numbers, this is one, that if they be multiplied by 40, and 9 be added to the Product, the Sum will be a Square Number.

HEPTAMERIS, EPTAMERIS, [of ἑπτὰ ſeven, and μέρος, Gr. Part or Portion,] a Term us'd in *Acouſticks* for the ſeventh Part of a *Meris*; and according to the Syſtem of Mr. *Sauvieur*, is the 43 part of the *Octave*.

HEPTANGULAR *Figure*, [in *Geometry*,] is that which conſiſteth of ſeven Angles.

HEPTHEMIMERIS, is a *Cæſura* in a *Latin* Verſe, where after the third Foot there is an odd Syllable, which ſerves to help make a Foot with the next Word; as in this:

Ille latus niveum molli fultus hyacintho.

HERALD, with us, ſignifies an Officer at Arms, whoſe Buſineſs it is to denounce War, to proclaim Peace, or otherwiſe to be employ'd by the Sovereign in Martial Meſſages and other Buſineſſes. The *French* call him *Herault*; *quaſi Herus altus*. But *Verſtegan* will derive the Word from two *Dutch* Words, *viz. Here*, *exercitus*, and *Healt*, *Pugil magnanimus*; as if he ſhould be ſo called, as being *Champion of the Army*. The *Romans* called Men of this Office in the Plural *Feciales*. With us they are the Judges and Examiners of Gentlemen' Arms: They Marſhal all the Solemnities at the Coronation of Princes; formerly manag'd Combats, &c.

The Three Chief Heralds with us are called *Kings at Arms*: The Principal of which is *Garter*, created by *Henry* V. His Office is to attend Knights of the Garter at their Inſtalments, or other Solemnities; to Marſhal the Funerals of all the greater Nobility, as Princes, Dukes, Marquiſſes, Earls, Viſcounts and Barons.

The next *Herald* is *Clarencieux*, Ordain'd by *Edward* IV. for his gaining the Dukedom of *Clarence*: His Office is to marſhal and diſpoſe the Funerals of all the leſſer Nobility; as of all Knights and Eſquires on this ſide *Trent*.

The Third is called *Norroy*, or *North-Roy*; whoſe Office is the ſame on the North Side of *Trent* as that of *Clarencieux* is on the South Side.

Beſides theſe there are Six others, which are properly called *Heralds*, according to their Originals, as they were Created to attend Dukes, &c. in their Martial Expeditions; as *York*, *Lancaſter*, *Somerſet*, *Richmond*, *Cheſter* and *Windſor*.

There alſo are four others call'd *Marſhals*, or *Purſuivants at Arms*, reckon'd after a manner in the Number of *Heralds*, and do commonly ſucceed in the Place of *Heralds* when they die, &c. and theſe are call'd *Blue-Mantle*, *Rouge Croſs*, *Rouge Dragon*, and *Port-Cullis*.

HERBAGE, [in *Law*,] the Paſture or Fruits of the Earth, provided by Nature for the Mouth of Cattle; alſo the Liberty of feeding Cattle in another Man's Ground.

HERBAL, a Book treating of Plants, or deſcribing the Figures, Genus, Species, Properties, Vertues, &c. of Herbs, Trees, Seeds, &c.; alſo a Set or Collection of Specimens of the ſeveral kinds of Plants dried and preſerved in the Leaves of a Book.

There is in the *Philoſophical Tranſactions*, a Method deſcrib'd for preſerving Specimens for ſuch an *Herbal*, *viz.* To gather the Flowers, Leaves, &c. when they are perfectly ripe, and in their true

Colours; then to ſpread them on brown Paper, with all their Parts diſplay'd as diſtinctly as poſſibly can be; to pare away one half of the Stem or Body of the Plant, if it be thick, in order to make it be flat: Then to lay a brown Paper over the Plants they ſpread, and to put the whole between two Iron Plates ſcrew'd tight together; then to put them into an Oven, and bake them for two Hours: Then to take them out and waſh them over with Brandy, or *Aqua Fortis*, and to lay them on a freſh Paper to dry: And in the laſt place, to lick over the back-ſides with a Bruſh dipt in a Diſſolution of *Gum Dragon*, to make them ſtick, and to lay them in the paper Book, and there they will lie faſt, and always look freſh.

HERBENGER, or *Harbinger*, is an Officer in the King or Queen's Houſe, who allotteth the Noblemen and thoſe of the Houſhold their Lodgings.

HECULIUS *Morbus*, the ſame with *Epilepſia.*

HEREDITAMENTS, [in *Law*,] ſignifies all ſuch Things immoveable, be they corporeal, or incorporeal, as a Man may have to himſelf and his Heirs, by way of Inheritance; or not being otherwiſe bequeathed, do naturally and of courſe deſcend to him and his next Heir of Blood, and fall not within the Compaſs of an Executor or Adminiſtrator, as Chattles do. It is a Word of large Extent, and much uſed in Conveyances; for by the Grant of *Hereditaments*, Iſles, Seigniories, Mannors, Houſes and Lands of all Sorts, Charters, Rents, Services, Advowſons, Commiſſions, and whatever may be inherited, will paſs.

HERETICO *Comburendo*: See *Hæretico*, &c.

HERIOT, was originally a Proportion of Horſe and Armour according to the Quality of the Deceas'd: This was ſettled by the Laws of King *Canutus*, cap. 69. and is ſtill (uſually) the beſt Riding Horſe of which a Tenant dies poſſeſs'd.

HERIOT *Cuſtom*, was when a Tenant for Life was by Cuſtom oblig'd to ſuch a Payment at his Death; which Payment to be made not only by the next Heir in Blood, but by any the next Succeſſor. In Abbeys of Royal Patronage, at the Death or Ceſſion of the Abbot, his Cup and Horſe were paid as an *Heriot* to the King. Thoſe alſo who held in Bondage and Villenage paid *Heriots*. The Religious Appropriators reſerv'd the *Live Heriots* (*i. e.* ſuch as were paid in Cattle) to themſelves, and allow'd the inanimate ones of ſmall Value to the Vicar: And ſome Appropriators had a *Heriot* from the Vicar when he died. *Kennet's Gloſſary.*

HERIOT *Service*, was a Reſerve by Charter or other Conveyance, and made on Condition of the Tenure of Eſtates in Fee Simple; which is now for the moſt part extinguiſh'd.

HERRISON, [in *Fortification*,] is a Beam arm'd with a great Quantity of ſmall Iron Spikes or Nails, having their Points outward, and is ſupported by a Pivot, upon which it turns, and ſerves inſtead of a Barrier to block up any Paſſage. They are frequently placed before the Gates, and more eſpecially the Wicket-Doors of a Town or Fortreſs, to ſecure thoſe Paſſages which muſt of Neceſſity be often open'd and ſhut.

HERMETICAL *Philoſophy*, is that which pretends to ſolve and explain all the *Phænomena* of Nature, by the three Chymical Principles, Salt, Sulphur, and Mercury.

HERMETICAL *Phyſick*, is that Hypotheſis in the Medicinal Art, which refers the Cauſe of all Diſeaſes to Salt, Sulphur and Mercury.

HERMETICAL *Seal*, or *Hermes's Seal*, or to Seal or Stop up any Glaſs *Hermetically*, is to heat the Neck of the Glaſs till 'tis juſt ready to melt, and then with a pair of hot Pincers to pinch or cloſe it together. This way are all *Thermometers* ſealed up, and the Chymiſts ſeal up thus a Liquor in a Matraſs, or Bolt-head, when they deſign it ſhould be long circulated in a gentle Heat.

HERMETICK *Art* is the ſame with Chymiſtry. 'Tis ſo called from *Hermes*, or *Mercury*, whom the Chymiſts will needs aſſert to have been the firſt and moſt famous Chymiſt.

HERMITAGE, ſtrictly ſignified a Convent of Hermits, or Friars Minors, who, under the Inſtitution and Diſcipline of St. *Paul*, inhabited Deſarts and ſolitary Places. But this Name at laſt came to be attributed to any one Religious Cell, built and endow'd in ſome private and recluſe Place, and then annex'd to ſome larger Abbey, of which the Prelate or Governour was called *Hermita*. Dr. *Kennet's Gloſſary.*

HERMITAN, is the Name of a dry North and North-Eaſterly Wind, which uſually blows on the Coaſt of *Guinea* in *Africk*; but ſometimes it blows alſo from other Points.

HERMITORIUN, is the Oratory or Chappel belonging to an Hermitage.

HERNIA, or *Ramex*, is properly the Falling of the Inteſtines, Cawl, &c. by the Proceſſes of the *Peritonæum*, dilated, into the Groin: Alſo a Protuberance of the Navel. The Falling down of the Womb is improperly ſo called; as alſo a ſwelling in the *Larynx*; winding Tumours of the Spermatick Veſſels; Diſtenſions from Flatulent Matter; watery Humours, or Swellings. *Blanchard.*

HERPES, a ſpreading and winding Inflammation, is two-fold; either *Militaris*, or *Puſtularis*, like Millet-ſeed, which ſeizes the Skin only, and itches; or *Exedens*, conſuming; which not only ſeizes the Skin, but the Muſcles underneath: The Cauſe of it is, That the Glandules of the Skin are too much ſtuffed with Salt Particles, which are kept there by others that are viſcous, whence proceed the little Ulcers like Millet-ſeed, that occaſion an itching in the Skin, which if the Peccant Humour abound, they grow into a Cruſt, and eat the Parts they lie upon. *Blanchard.*

HERSE, [in *Fortification*,] is a *Lattice* or *Portcullice*, made in the Form of a Harrow, and beſet with many Iron Spikes. It is uſually hung by a Cord faſten'd to a Moulinet, which is cut in caſe of Surprize, or when the firſt Gate is broken with a *Petard*, to the end that the *Herſe* may fall, and ſtop up the Paſſage of the Gate, or other Entrance of a Fortreſs. Theſe *Herſes* are alſo often laid in the Roads to incommode the March as well of the Horſe, as of the Infantry.

HERSILLON, [in *Fortification*,] is a Plank ſtuck with Iron Spikes, for the ſame Uſe as the *Herſe*.

HETEROCLITES, [Ἑτερόκλιτα, Gr.] in *Grammar*, are ſuch Nouns as are of different Declenſions in one Number, from what they are in the other.

HETEROCRANIA, [Ἑτεροκρανία, Gr.] is a Pain in one Part or other of the Head.

HETERODROMUS, [in *Staticks*,] is the Term for the common *Vectis* or *Leaver*, which hath the *Hypomochlion* placed below the *Power* and the *Weight*; and where the Weight is elevated by the Deſcent of the Power, & *vice verſa*. (See the *Fig.* in *Homodromus*.)

The *Dung-fork* and *Prong* are Leavers of this kind, whoſe *Hypomochlion* is uſually the Knee of the Workman: And all Pincers, Sheers, Sciſſars, Cutting-Knives faſten'd to Blocks, are double.

HETERODROMOUS *Leavers.* The Wheel, Windlaſs, Capſtan, Crane, *&c.* are perpetual *Heterodromous Leavers:* As are alſo the outermoſt Wheels of all Wind and Water-Mills, and all Cog-Wheels, *&c.*

HETERODROMUS *Vectis,* [in *Mechanicks,*] when the Weight to be raiſ'd by a Leaver is placed beyond the *Hypomochlion* or *Fulcrum,* and ſo moves a contrary way to the Power, *viz.* is raiſ'd when that deſcends, and deſcends when that riſes.

HETEROGENEAL, HETEROGENEOUS, [of ἑτερογὲνης, Gr. of Ἕτερος another, and γὲνος, Gr. kind,] of a different Nature, or conſiſting of Parts of differing Kinds.

HETEROGENEAL *Nouns,* [of ἑτερογένης, Gr.] in *Grammar,* are ſuch as have one Gender in the Singular Number, and another in the Plural, as *Tartarus, Tartara; Locus, Loca, &c.*

HETEROGENEAL *Numbers,* are mix'd Numbers conſiſting of Whole ones (or Integers) and of Fractions.

HETEROGENEAL *Surds,* are ſuch as have different Radical Sines; as

$$\overset{2}{\surd}\ aa: \text{ and } \overset{5}{\surd} : bb : \overset{5}{\surd} : 7, \text{ and } \overset{3}{\surd} : 19.$$

How to reduce Surds to Homogeneal ones, ſee under *Surds.*

HETEROGENEAL *Light,* is by our admirable Sir *Iſaac Newton* ſaid to be that which conſiſts of Rays of differing Degrees of Refrangibility: Thus, the common Light of the Sun or Clouds is *heterogeneal,* being a Mixture of all Sorts of Rays. See *Colours.*

HETEROGENEITY, [in *Phyſicks,*] a Term uſed to denote the Quality or Diſpoſition that denominates a Thing *heterogeneous.*

HETEROGENEOUS, [in *Mechanicks,*] is a Term apply'd to ſuch Bodies, the Denſity of which is unequal in differenr Parts of their Bulk; or *heterogeneous Bodies* are ſuch, whoſe Gravities are not proportionable to their Bulks.

HETEROGENEOUS *Particles,* are ſuch as are of different Kinds, Natures, and Qualities, of which, generally, all Bodies are compoſed: And therefore, when in Chymiſtry a Body is analyſed or diſſolved by the Fire, or any *Menſtruum;* if Parts or Principles of different Natures (ſuch as Salt, Oil, Spirit, Water, and Earth) can be ſeparated from it; thoſe are called *Heterogeneities* (by *Helmont*) becauſe they are all of very different Kinds or Natures from one another.

HETEROGENEOUS *Quantities,* are ſuch as are of ſo different a Kind and Conſideration, as that one of them taken any Number of Times, never equals or exceeds the other.

HETERORHYTHMUS, [of ἕτερος another, and ῥυθμός, Gr.] a Courſe of Age unſuitable to thoſe that live it; alſo a Term apply'd to Pulſes, when they beat variouſly and irregularly in Diſeaſes.

HETEROSCII, [Ἑτερόσκιοὶ of ἕτερος another, and σκιὰ, Gr. a Shadow,] in *Coſmography,* are ſuch Inhabitants of the Earth as have their Shadows falling but one way; as thoſe who live between the Tropicks and Polar Circles, whoſe Shadows at Noon in North Latitude, are always to the Northward, and in South Latitude to the Southward.

HEXACHORD, [Ἑξαχόρδον, Gr.] a certain Interval of Muſick or Concord, commonly called a *Sixth;* and is two-fold, *viz.* the *Greater* and *Leſſer.*

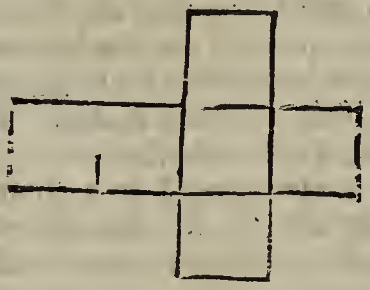
The *Greater Hexachord* is compoſed of two greater Tones, two leſſer Tones, and one greater Semi-Tone, which are five Intervals: But the *Leſſer Hexachord* conſiſts only of two Greater Tones, one Leſſer Tone, and two Greater Semi-Tones.

The Proportion of the former, in Numbers, is as 3 to 5; and that of the other, as 5 to 8.

HEXAGON, [Ἑξάγωνος of ἓξ Six, and γωνία, Gr. an Angle,] in *Geometry,* is a Figure of ſix Sides and Angles; and if thoſe Sides and Angles be equal, 'tis called a *Regular Hexagon.*

HEXAHEDRON, [Ἑξαέδρον, Gr.] is the ſame with the Cube, being a Regular Solid of ſix equal Sides or Faces. See *Regular Bodies.*

The following Figure, being cut in Paſte-board and folded up, will repreſent the *Hexahedron* or *Cube.*



HEXAMETER, [Ἑξάμετρον of ἓξ ſix, and μὲτρον, Gr. Meaſure,] a Verſe in *Greek* or *Latin,* conſiſting of ſix Feet, the firſt four of which may be indifferently either *Dactyls* or *Spondees;* the laſt Foot always a *Spondee,* and the laſt but one a *Dactyl.*

HEXASTYLE, [Ἑξάστυλη of ἓξ and στυλὴ, Gr. a Column,] an antient Building which had ſix Columes in the Face before, and ſix alſo behind, and is the ſame with the *Pſeudodipteron.*

HEYBOTE, or *Haybote,* was antiently the *Saxon* Term for the Liberty granted to a Tenant for cutting ſo much Under-wood, Buſhes, *&c.* as was neceſſary for Mending and Maintaining the Hedges or Fences belonging to his Land.

HIDAGE, was a Royal Aid or Tribute raiſ'd in ſuch a Proportion on every Hide of Land: *William the Conqueror* impoſed ſix Shillings on every Hide; and *William Rufus* Four Shillings; and K. *Henry* I. Three Shillings. When the Lord paid *Hidage* to the King, the Tenants paid a Proportion to the Lord of the Mannor.

King *Etheldred,* when the *Danes* landed at *Sandwich,* raiſ'd this *Hidage* ſo, that every 310 Hides of Land found an arm'd Ship; and every 8 Hides found a *Jack* and a *Saddle.*

HIDE *of Land,* or *Plough-Land,* was as much as one Plough could cultivate in a Year; for the Quantity was never expreſly determin'd: Some call it 60, ſome 80, and ſome 100 Acres. One *Hide* of Land at *Cheſterton* in the 15th of *Hen.* II. contain'd 64 Acres: And in the 35th of *Hen.* III. the yearly Value of a *Hide of Land* at *Blecheſdon* in *Oxfordſhire* was Forty Shillings. *Kennet's Paroch. Antiq.*

Bede calls it *Familiam,* implying by it, that it was as much as would maintain a Family.

The Diſtribution of *England* by *Hides of Land* is very antient: Mention being made of it in the Laws of King *Ina, cap.* 14. And *Henry* I. to Marry his Daughter, had Three Shillings from every *Hide of Land.* This Tax was call'd *Hidage.* See *Hidage.*

HIDEL [in *antient Statutes*] a Place of Protection, or a Sanctuary.

HIDROA, are Pimples about the Secret Parts, proceeding from a ſharp Humour. *Blanchard.*

HIDRONOSUS, is a Fever wherein the Patient ſweats extremely. The *Engliſh* call it the *Sweating-Sickneſs.* *Blanchard.*

HIDROTICK *Medicines*, are thoſe that procure and promote Sweating. See *Sudorificks.*

HIP-*Roof*, [in *Architecture*] is ſuch a Roof as hath neither *Gable-Heads*, *Spread-Heads*, nor *Jerkin-Heads*: (By which is meant ſuch Heads as are both Gable and Hip at the ſame End; that is, Gable as far as the Cot or Beam, and then their over ſhort Hips, which ſhut up with their Tops to the Tops of a pair of Rafters, call'd *Singlers* by the Country Workmen:) For a *Hip-Roof* hath Rafters as long, and with the Angles at the Foot, *&c.* at the Ends of Buildings, as it hath on the Sides: And the Feet of the Rafters on the Ends of ſuch Buildings as have *Hip-Roofs*, ſtand on the ſame Plane, *viz.* parallel to the Horizon, and at the ſame height from the Foundation with the Rafters at the Sides of the Roofs. Theſe *Hip-Roofs* ſome call *Italian Roofs.*

HIPS [in *Architecture*] are thoſe Pieces of Timber which are at the Corners of a Roof: They are a good deal longer than the Rafters, becauſe of their oblique Poſition; for they are level at every Angle. The Country Workmen call them Corners; and by ſome they are call'd *Principal Rafters*, by others *Sleepers.* As Rafters have four plain Sides, theſe have uſually five.

HIPPEUS, or *Equinus*, a Comet that ſome Writers will needs have to reſemble a Horſe: But the Shape of this kind of Comet is not always alike, as being ſometimes Oval, and ſometimes imitating a *Rhomboides.*

Its Train, in like manner, is ſometimes ſpread from the Front, or Fore-part; and at other times from the Hinder-part: Therefore they are diſtinguiſhed into *Equinus Barbatus*, *Equinus Quadrangularis*, and *Equinus Ellipticus.*

HIPPOCRATES'S *Sleeve*, [in *Pharmacy*,] a kind of Filter or ſtraining Bag, form'd by joining the oppoſite Angles of a Square Piece of Flanel in the Form of a Pyramid, uſed in the Percolation or Straining of Syrups, Decoctions, *&c.* in order to clarify them.

HIPPODROME, [ἱππόδρομος of ἵππος an Horſe, and δρόμος, Gr. a Courſe,] a Liſt or Courſe among the Antients, where the Horſe-Races were perform'd, and alſo their Horſes exerciſed.

HIPPOMANES, [ἱππομανὲς of ἵππος and μανία, Gr. Fury,] a kind of Poiſon famous among the Antients, as an Ingredient in amorous Philtres or Charms. *Pliny* deſcribes it as a blackiſh Caruncle found on the Head of a new born Colt, which the Mare bites off and eats as ſoon as ſhe has foaled. *Columella*, &c. deſcribes it as a poiſonous Matter which trickles from the *Pudendum* of the Mare when proud, or deſirous of Copulation.

HIPPUS, is an Affection of the Eyes, wherein they continually ſhake and tremble, and now and then twinkle, as it happens in Riding. *Blanchard.*

HIRCUS, *Hirci*, or *Hirqui*, the Corners of the Eyes. See *Canthus.* *Blanchard.*

HIRCUS, a fix'd Star; the ſame with *Capella. L.*

HIRCUS, a Name given by ſome Writers to a ſort of a Comet, encompaſſed by a kind of Mane, ſeeming to be rough and hairy, by reaſon of its Rays appearing like Hairs. It is alſo ſometimes without any Train or Buſh.

HIRQUUS, the ſame with *Canthus.*

HISTIODROMIA [of ἱϛίον a Sail, and δρόμος a Courſe, of δρέμω, Gr. to run, whence ἱϛιοδρομέω to go with ſpread Sails.] Navigation, or the Art of Sailing. It turns on four Points, the difference of Latitude, the difference of Longitude, the Courſe, and the diſtance run, any two of which being given, the other two may eaſily be found from them by the *Loxodromick* Tables.

HISTORIOGRAPHER [ἱϛοριόγραφος of ἱϛορία a Hiſtory, and γράφω, Gr. to deſcribe] a profeſs'd Hiſtorian or Writer of Hiſtory.

HISTORY [Ἱϛορία of ἱϛορεῖν, Gr. which properly ſignifies, to know a thing by having ſeen it] a recital or deſcription of things, as they are or have been in a continued orderly Narration of the principal Facts and Circumſtances thereof.

Natural HISTORY, a deſcription of Natural Bodies, whether they be *Terreſtrial*, as Animals, Vegetables, Foſſils, Fire, Water, Air, Meteors, *&c.* or *Celeſtial*, as the Stars, Planets, Comets, *&c.* It deſcribes the Singularities of Nature, the Irregularities and Prodigies of it, and the Alterations it undergoes in the Birth, Progreſs, End, and Uſe of Things.

HISTORY [in reſpect to *Actions*] is a continued Relation of a Series of memorable Events in the Affairs or Concerns, either of a Nation, of ſeveral Perſons and Nations, or of a ſingle Perſon, either during the ſpace of a longer or ſhorter Time.

Perſonal HISTORY, gives the Portrait of ſome ſingle Perſon, the ſame that is otherwiſe called *Biography.*

Sacred HISTORY is that which relates the Myſteries and Ceremonies of Religion, Appearances of the Deity, his Meſſengers, Viſions, *&c.* Miracles and other ſupernatural Things, whereof God only is Author.

Civil HISTORY is that which gives an account of People, States, Republicks, Cities, Communities, *&c.*

Singular HISTORY is that which deſcribes one ſingle Action, Siege, Battle, or even of a War or Expedition.

Simple HISTORY is one which is delivered without any Art or foreign Ornament; being only a faithful and naked recital of Things, juſt in the ſame Manner and Order as they were tranſacted or paſt.

Figurate HISTORY is one which is enrich'd with Ornaments, by the Wit, Ingenuity, and Addreſs of the Hiſtorian.

HISTORY [in *Painting*] is uſed of a Picture, compos'd of divers Figures or Perſons, repreſenting ſome Piece of Hiſtory, either real or feigned.

HISTRIO [in the *antient Comedy*] a Buffoon or Droll, who acted ſome humorous Part to excite Merriment and Laughter. *L.*

HITCH, is a Sea Word, to catch hold of any Thing with a Hook or a Rope, and to hold it faſt. Thus they ſay, when the Boat is to be hoiſed in, *Hitch the Tackles into the Rings of the Boat*; ſo, *Hitch the Fiſh-hook to the Fluke of the Anchor*, when they are about to weigh the Anchor.

HOBELERS, were formerly a ſort of light Horſe-Men, which rode on ſmall nimble Horſes, and with only light Armour on; ſo that they were fit (like our Dragoons) for any expeditious Service: At length they became ty'd by their Tenure, to maintain a little light Nag, for giving expeditious Notice of any Invaſion or Danger: See 18 *Edw.* III. *c.* 7. 25 *Edw.* III. *c.* 5, 8. and *Cambd. Britan.*

HOBITS, are a ſort of ſmall Mortars from ſix to eight Inches Diameter: Their Carriages are like thoſe of Guns, only much ſhorter. They are very good for annoying the Enemy at a diſtance with ſmall Bombs, which they will throw two or three Miles: Or in keeping of a Paſs, being loaded with Cartouches.

HODOMETRICAL [of ὁδὸς a way, and μέτρον, Gr. Meaſure,] a *Method* of finding the Longitude at Sea, is that of the Computation of the *Meaſure of the Way* of a Ship between Place and Place; *i.e.* of obſerving the ſeveral Rhumbs or Lines in which the Ship ſaileth; and *what Way* ſhe hath made, or how many Leagues and parts of a League ſhe hath run.

HOGENHINE, was formerly the Term for one that coming Gueſt-wiſe to an Inn or Houſe, lay there the third Night: After which he was accounted one of the Family; and the Hoſt was anſwerable for his Breach of the King's Peace. In the Laws of K. *Edward*, ſet forth by *Lambert*, he is call'd *Agenhine*; and often in other Places *Third-Night Awnehine.*

HOISE: See *Hoyſe.*

HOKE-*Day*, was the *Tueſday* Fortnight after *Eaſter-Day*; and was antiently celebrated with Sports and Rejoicings, in Memory of many of the *Danes* being kill'd on that Day, and the reſt expell'd the Kingdom. This was done *A. D.* 1002. in the Reign of K. *Etheldred.*

HOKE-*Tueſday-Money*, was a Duty paid by the Tenants to their Landlord, to have leave to celebrate the *Hoke-Day.*

HOLD, of a *Ship*, is all that part of it, which lies between the Keelſon and the Lower-Deck; wherein, divided by Bulk-heads, are the Steward's Room, the Powder-Room, the Bread-Room, and the Boatſwain's-Room; and in a Merchant-Man, the Goods or Lading in general.

HOLD-OFF, is a Term at Sea, uſed about heaving in the Cable at the Capſtan: For if it be very ſtiff and great, or have lain long in a ſlimy or oazy Ground, unleſs that Part which is heaved in by, be haled away hard from the Capſtan, the Cable will *ſurge* or ſlip back; therefore it muſt be haled away as faſt as it comes in, that the Cable may keep cloſe about the Whelps: And this Work is called *holding-off*, and may be done by Hand with a ſmall Cable; but in all great Ships they either *hold-off* with Nippers, or elſe bring the Cable alſo to the Jeer-Capſtan.

HOLLOW-*Tower*, [in *Fortification*,] is a Rounding made of the Remainder of two Briſures, to join the Curtain to the *Orillon*, where the ſmall Shot are plaid, that they may not be ſo much expoſed to the View of the Enemy. And the

HOLLOW-*Square*, is a Body of Foot drawn up, with an empty Space in the Middle for the Colours, Drums, and Baggage, facing and covered by the Pikes every way to oppoſe the Horſe.

HOLLOW, [in *Architecture*,] a concave Moulding about a Quadrant of a Circle, which ſome call a *Caſement*, and others an *Abacus.*

HOLOMETER, [ὁλομετρεῖν of ὅλος the whole, and μέτρον, Gr. Meaſure,] a mathematical Inſtrument that ſerves univerſally for taking all manner of Meaſures, both on the Earth and in the Heavens.

HOLSOM, [in *Sea Language*,] a Ship is ſaid to be *holſom*, when ſhe will hull, try, and ride well at Sea, without labouring or rolling.

HOMAGE, is the Submiſſion, Promiſe, and Oath of Service and Loyalty which a Tenant makes to his Lord, when he is firſt admitted to his Land, which he holds of the Lord in Fee, ('tis probably derived from the Word *Homo*;) becauſe the Form, as appointed by *Stat.* 17. *Edw.* 2. in theſe Words; When a Free-man ſhall do *Homage* to his Lord, of whom he holdeth in Chief, he ſhall hold his Hands together between the Hands of his Lord, and ſhall ſay thus:

> *I become your Man from this Day forth for my Life, for Member, and for Worldly Honour; and ſhall owe you my Faith for the Land I hold of you, ſaving the Faith that I owe unto our Sovereign Lord the King, and to mine other Lords.*

And in this manner the Lord of the Fee, for which Homage is due, taketh Homage of every Tenant as he cometh to the Land or Fee.

HOMAGE is ſometimes uſed for the Jury in a Court-Baron, where it conſiſteth moſt commonly of ſuch as owe Homage unto the Lord of the Fee.

HOMAGE *Anceſtrel*, is where a Man and his Anceſtors, time out of Mind, held their Land of their Lords and his Anceſtors by Homage: And if ſuch Lord have received Homage, he is bound to acquit the Tenant againſt all other Lords above him, of every manner of Service. And if the Tenant hath done Homage to his Lord, and is impleaded, and vouches the Lord to Warranty, the Lord is bound to warrant him; and if the Tenant loſe, he ſhall recover in Value againſt the Lord, ſo much of the Lands as he had at that time of the Voucher, or any time after.

HOMAGE *Liege*, a more extenſive kind of Homage, by which a Vaſſal held of his Lord, not only for his Lands, but for his Perſon. — So that his Lord might make Uſe of him, againſt all Mankind, except the King, whether within the Kingdom or out of it.

This kind of Homage was rendred bare-headed, with the Hands joined on the Goſpels, with one Knee on the Ground, and without either Girdle or Spurs: And by theſe it was diſtinguiſhed from *Frank Homage.*

HOMAGE *of Fee*, was where no Oath of Fidelity was taken.

HOMAGE *of Peace*, is a Homage which a Perſon does to another after a Reconciliation, as an Aſſurance that he will no more diſturb his Peace, &c.

HOMAGE *of Devotion*, is a Donation made to the Church, and does not import any Duty or Service at all.

HOMAGE is alſo us'd for the particular Place or Diſtrict where Services are to be performed.

HOMAGER, is one who does or is bound to do Homage to another.

HOMAGIO *Reſpectuando*, is a Writ directed to the Eſcheator, commanding him to deliver Seiſin of Lands to the Heir that is of full Age, notwithſtanding his Homage not done, which ought to be performed before the Heir have Livery, or his Lands, except there fall out ſome reaſonable Cauſe to hinder it. *L.*

HOMAGIUM *Reddere*, was renouncing Homage, when a Vaſſal made a ſolemn Declaration of diſowning and defying his Lord; for which there was a ſet Form and Method preſcrib'd by the *Feudatory Laws.*

HOMICIDE, [in *Common Law,*] ſignifies the Killing of a Man, and it is divided into *Voluntary* and *Caſual.*

Homicide Voluntary, is that which is deliberate, and committed of a ſet Mind and Purpoſe to kill, and is either with a precedent Malice, or without: The former is Murder, and is a fellonious Killing, through Malice prepenſed, of any Perſon living in this Realm under the King's Protection: See *Murder*, *Man-ſlaughter*, *Chance-medley.*

Homicide Caſual, is either *merely Caſual* or *Mixt.*

Meerly Caſual, is when the Slayer kills a Man by pure Miſchance, being about his lawful Occaſions; as in the Caſe of an Axe ſlipping out of a Man's Hand, or falling off while he is felling a Tree.

But 'tis accounted *Mixt*, when there is Negligence, or ſome other unwarrantable Circumſtance, ſeized with the Action.

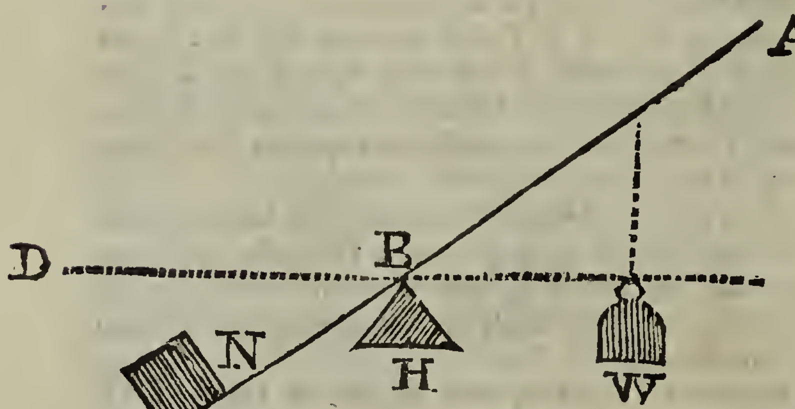
HOMINE *capto in Withernamium*, is a Writ to take him that hath taken any Bond-man or Woman, and let him or her out of the Country, ſo that he or ſhe cannot be replevied according to Law.

HOMINE *eligendo ad cuſtodiendam peciam ſigilli pro mercatoribus æditi*, is a Writ directed to a Corporation, for the Choice of a new Man to keep the one Part of the Seal, appointed for *Statutes-Merchant*, when the other is dead. *L.*

HOMINE *replegiendo*, is a Writ to bail a Man out of Priſon: In what Caſe it lies, ſee the *New Book of Entries.* *L.*

HOMOCENTRICK, the ſame with *Concentrick.*

HOMODROMUS, is a Term in *Staticks* for a Leaver, as *A B*; one of whoſe Ends, *B*, is fixed on the Obex or Hypomoclion *H:* And the other End *A*, is applied to the moving of the Weight *W*, which hangs or lies ſomewhere in the middle, between the Hypomoclion *H*, and the Power in *A*. Here the Weight moves the ſame way with the Power: Whence this kind of *Vectis* takes its Name of *Homodromus.* Whereas, in the other Leaver, the Weight *N* is raiſed up by means of the Obex or Hypomoclion *H*; while the Power at *A*, the other End of the Leaver, deſcends; and therefore this is called *Heterodromus.* Of this homodromous kind of Leavers, are the Rudders and Oars of Ships and Boats; as alſo their Maſts.



HOMOGENIAL [ὁμογενής, Gr.] ſignifies of the ſame Kind or Sort, or that which differs not in Nature, &c. The ſame with *Homogeneous.*

HOMOGENEAL *Numbers*, are thoſe of the ſame Nature and Kind: And

HOMOGENEAL *Surds*, are ſuch as have one common Radical Sign; As,

$$\sqrt[3]{\ }:27, \text{ and } \sqrt[3]{\ }:3.$$

HOMOGENEAL *Light*, is that whoſe Rays are all of one Colour and Degree of Refrangibility, without any Mixture of others. See *Colours.*

HOMOGENEOUS *Particles*, are ſuch as are all of the ſame Kind, Nature, and Properties: As the Parts of pure Water, of mere Earth without Salt in it; or the Parts of the finer Metals, ſuch as Gold, Silver, &c. 'Tis uſed in Oppoſition to *Heterogeneous:* Which ſee.

HOMOGENEUM *Comparationis*, ſo *Vieta* calls the *Abſolute Number* in a Quadratick or Cubick, &c. Equation; and this Number always poſſeſſeth one Side of the Equation, and is the Product of the Roots multiplied one into another; therefore *Oughtred* expreſſes it by this Character *Æ*, becauſe 'tis a Rectangle between the two Roots *A* and *E*. The Reaſon of the Name is, that all the Roots, which being multiplied into one another, do produce the abſolute Number, muſt be homogeneous one to another. See *Abſolute Number.*

HOMOIOMERICAL *Principles* of *Anaxagoras*, [of ὅμοιος and μέρος, Gr. Part:] This antient Philoſopher ſuppoſed, that there were in all mixt Bodies, (ſuch as Fleſh, Fruits, &c.) determinate Numbers of ſuch *ſimilar Principles*, as when they came to become Parts (*ex. gr.*) of an Animal Body, would there make ſuch Maſſes and Combinations as their Nature required, *viz.* the *Sanguinary Particles* would then meet all together, and make *Blood*; the *Urinous Particles* would conſtitute *Urine*; the *Oſſeous* ones *Bones*; the *Carneous* ones *Fleſh*, &c.

HOMOLOGATION, [in the *Civil Law,*] is the Act of confirming or rendring a Thing more valid and ſolemn, by a Publication, Repetition, or Recognition of it.

HOMOLOGOUS, [ὁμόλογος of ὅμοιος like, and λόγος, Gr. a Word,] in *Geometry*, ſignifies thoſe Quantities which are alike to one another in *Reaſon*; as when we ſay, there is the ſame *Reaſon* of *A* to *B*, as of *C* to *D*: here *A* is *homologous* to *C*, as *B* to *D*, becauſe of the Similitude between Antecedents and Conſequents: So that the two Antecedents, and the two Conſequents, are the *homologous* Terms in any Proportion; and when Triangles are ſimilar, the Sides which are the two Antecedents or the two Conſequents, are called the *homologous* Sides: and ſuch Triangles are always to one another as the Squares of ſuch *homologous* Sides, as you will find proved under *Triangles.*

HOMOLOGOUS *Things*, [in *Logick,*] are ſuch as agree only in Name, but are of very different Natures; and therefore are the ſame with what they otherwiſe call Equivocal Terms.

HOMONYMIA, [ὁμωνυμία of ὅμοιος like, and ὄνυμα, Gr. a Name,] an Equivocation. *Logick.*

HOMONYMOUS, [in *Logick,*] a Term apply'd to ſuch Words which have two different Significations.

HOMOPLATA, [ὁμοπλάτη, Gr.] *Scapulæ Spatulæ*, *Scapulæ Apertæ*, the Shoulder-Blades, are two large, broad, and triangular Bones, which conſtitute the Breadth of the Shoulder; thin, eſpecially in the Middle, but thick in its Proceſſes, and are ſituated on each Side of the Upper and Back-part of the *Thorax*; the upper Edge of them is called *Coſta Superior*; their lower *Coſta Inferior.*

Each has three Proceſſes; of which, the Firſt runs all along the Middle of their Outſide, and is called their *Spine*, whoſe End, which receives the *Clavicula*, is called the *Acromion*, or the Shoulder-point. *Caracoides*, or *Anchoralis*, is the Name of the ſecond Proceſs; as the Third is called *Cervix*: Theſe two latter are tied together by a ſtrong Ligament, which ſerves to keep the Head of the *Humerus* in the Cavity of the *Cervix*. The Uſe of the *Homoplata*, or *Scapulæ*, is to receive the Extremities of the *Claviculæ* and *Humeri* for the eaſier Motion of the Arm, and to give Eaſe to the Muſcles which move it.

HOMOTONA, [of ὁμότονος, Gr.] is a continued Fever that acts always alike. *Blanchard.*

HONOR, is uſed for the nobler ſort of Seigniories, whereon other inferior Lordſhips and Mannors do depend, by performance of Cuſtoms and Services to thoſe that are Lords over them: And it ſeems as if none were *Honors* originally, but ſuch as belong'd to the King, tho' given afterwards in Fee to Noblemen. The Manner of Creating theſe *Honors*, may in part be collected from the Statutes 34 *H.* VIII. *c.* 5. where *Hampton-Court* is made an *Honor*: And 33 *H.* VIII. *c.* 37, 38. where *Grafton* and *Ampthill* are made *Honors*. There are many other *Honors* in *England*; See 37 *H.* VIII. *c.* 18, *&c.*

HONOR-*Courts*, are ſuch Courts as are held within the above-mention'd Honors.

HONORARY *Services*, are ſuch as are incident to *Grand Sergeantry*, and annexed uſually to ſome *Honor*.

HONOUR-*Point*, in an Eſcutcheon: See *Eſcutcheon.*

HONOURABLE *Amends*, [*Amende honorable*, F.] an infamous ſort of Puniſhment us'd in *France*, &c. on Traitors, Parricides, ſacrilegious Perſons, and other heinous Criminals. The Offender is delivered up to the common Hangman, who firſt ſtrips him to his Shirt, then puts a Halter about his Neck, and a Wax Taper into his Hand, and then leads him about the Court, where he muſt beg Pardon of God, the King, the Court, and his Country; and ſometimes he is afterwards condemn'd to the Galleys, or to Death.

HONOURABLE *Ordinaries*, [in *Heraldry*,] are the Principal Ordinaries or Bearings, which may poſſeſs one third of the Field, when they are in their full Extent: Theſe are nine, according to ſome, *viz.* The *Croſs*, *Chief*, *Pale*, *Bend*, *Feſſe Chevron*, *Saltier*, *Giron*, and *Scutcheon*. To which by others are added the *Bar*, the *Bordure*, &c.

HONEY-COMBS, are certain Holes or Cavities within the Body of a great Gun, wherein there is Danger of ſome Sparks of Fire being lodged, or Pieces of Cartridges, where they uſe Paper Cartridges.

HOOKS, of a Ship, are all thoſe forked Timbers which are placed directly upon the Keel, as well in her *Run*, as in her *Rake*.

HOOK-*Pins*, are taper Iron Pins, with an hook Head; and are uſed to pin the Frame of a Floor or Roof together, by being put in through the Pin-holes in the Morteſſes and Tennons, whilſt it is framing or fitting into its due Poſition: as ſoon as which is done, theſe Hook-Pins are ſtruck out, and 'tis pinn'd up faſt with Wooden Pins.

HOOP-WHEEL: See *Detent-Wheel.*

HOPLO *Chryſma*, [of ὅπλον a Weapon, and χρίσμα, Gr. Salve,] the *Armarium* or *Weapon Salve*: See *Armarium.*

HORARY, [*Horarius*, L.] relating to, or pertaining to Hours. As,

HORARY *Circles* of the Globe: See *Globe.*

HORARY *Circles*, [in *Dialling*,] are the Circles or Lines which mark the Hours on Sun-Dials.

HORARY *Motion of the Earth*, [in *Aſtronomy*,] is an Arch that the Earth deſcribes in the Space of an Hour, *i. e.* 15 Degrees, not exactly, (becauſe the Earth moves according to its greater or leſs Diſtance from the Sun) but it is near enough for ordinary Computations.

HORDEATUM, is a liquid Medicine taken inwardly, prepared of Barley beaten and boil'd, with the Addition of ſuitable and well-ſtrained Liquors; to which are frequently added Almonds, and the Seeds of white Poppies, *&c.* *Blanchard.*

HORDEOLUM, the ſame with *Critha.*

HORIZON, [Ὁρίζον of ὁρίζω, Gr. to terminate,] is that great Circle which divides the Heavens and the Earth into two Parts or Hemiſpheres, diſtinguiſhing the upper from the lower: It's either *Senſible* or *Apparent*, or the *Rational* or *True Horizon.*

The *Senſible* or *Viſible Horizon*, is that Circle which limits our Sight, and may be conceived to be made by ſome great Plane, or the Surface of the Sea.

It divides the Heavens and Earth into two Parts, the one light, and the other dark, which are ſometimes greater and leſſer, according to the Condition of the Place, *&c.*

It determines the Riſing and Setting of the Sun, Moon, or Stars, in any particular Latitude; for when any of theſe appears juſt at the Eaſtern Part of the Horizon, we ſay it Riſes; and when it doth ſo at the Weſtern Part, we ſay it Sets: and from hence alſo the Altitude of the Sun or Stars is accounted, which is their Height above the Horizon.

The *Rational*, *Real*, or *True Horizon*, is a Circle which encompaſſes the Earth exactly in the Middle, and whoſe Poles are the *Zenith* and *Nadir*; that is, the two Points, one exactly over our Heads, and the other under our Feet.

Horizon on the *Globe* or *Sphere*, is a broad wooden Circle encompaſſing it round, and repreſenting the *Rational Horizon*, having two Notches in the North and South Parts of it for the Brazen Meridian to ſtand in.

On this broad wooden Horizon ſeveral Circles are drawn, the innermoſt of which is the Number of Degrees of the 12 Signs of the Zodiack, *viz.* 30 Degrees to each Sign.

Next to this you have the Names of thoſe Signs; then the Days of the Month, according to the *Julian* Account, or Old Stile, with the Calendar; and then a Calendar according to the Foreign Account, called New Stile: and without theſe is a Circle divided into 32 equal Parts, which make 32 Rhumbs, or Points of the Mariner's Compaſs, with the firſt Letters of their Names annexed.

The Uſes of this Circle on the Globe are,

1. To determine the Riſing and Setting of the Sun, Moon, or Stars; and to ſhew the Time of it by the Hour-Circle and the Index.

2. To limit the Increaſe and Decreaſe of Day and Night: For when the Sun riſes due Eaſt, and ſets Weſt, the Days and Nights are equal: When he

riſes and ſets to the North of the Eaſt and Weſt, the Days are longer than the Nights: But the Nights are longer than the Days, when the Sun riſes and ſets to the Southward of the Eaſt and Weſt Points of the *Horizon.*

3. To ſhew the Amplitude and Point of the Compaſs the Sun riſes and ſets upon.

HORIZONTAL, or *Baſe-Line of a Hill*, how to find: See *Surveying.*

HORIZONTAL *Dials*, are thoſe whoſe *Planes* lie parallel to the Horizon of any Place.

For the drawing of theſe *Dials*, you muſt have always given the *Latitude of the Place*, or Height of the Pole above the Horizon, (*which is equal to the Height of the Style*) by the help of which you may find the *Hours Diſtance from the Meridian* by the following Proportion:

As the Radius: Is to the Sine of the *Styles Height*::
So is the Tangent of the Hour (or *Angle at the Pole*):
To the Tangent of the *Hours Diſtance from* 12, (or the *Hour-Arch.*)

Example.

Suppoſe an *Horizontal Dial* was to be drawn for the Latitude of 51 Degrees 32 Minutes,

Firſt, Find the Diſtance of the Hours 1 and 11 from the Meridian, according to the preceding *Canon*:

Thus,

To the S. of the *Styles Height*—51° 32′—9.893745
Add the Tangent of the Hour---15 00—9.428052

Sum---Rad. = T. of the *H. Arc.* 11° 50′—19.321797

Which is the Diſtance of 1 and 11 from the *Meridian Line.*

In like manner find the reſt of the Hours Diſtances, and place them in a Table:

Thus,

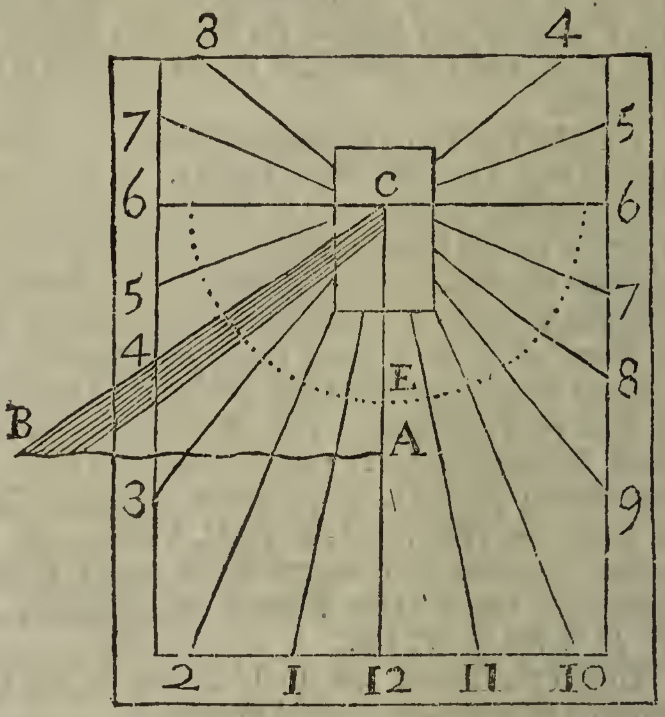
Latitude 32 Degrees 51 Minutes North.					
Hours.		Angle at Pole.		Hour Arches.	
		G.	M.	G.	M.
12		00	00	00	00
11	1	15	00	11	50
10	2	30	00	24	20
9	3	45	00	38	03
8	4	60	00	53	35
7	5	75	00	71	06
6		90	00	90	00

For the Style, make the Angle *B C A* = to the Latitude of the Place.

So ſhall *B C A* be the Style or Cock, which muſt ſtand perpendicularly on *C*: 12, and Point due North.

If you would Calculate for every half Quarter, you muſt ſay,

As *R* : *S* Latitude : : *T*, 1 Degree 52 Minutes :
To the Tangent of the firſt half Quarter's Diſtance from the Meridian : :
So *T*, 3 Degrees, 45 Minutes : To *T*, of the firſt Quarter of an Hour's Diſtance : :
So *T*, 5 Degrees 37 Minutes : To a Quarter and half Quarter's Diſtance : :
So *T*, 7 Degrees 30 Minutes : To the half Hour's Diſtance, *&c.*

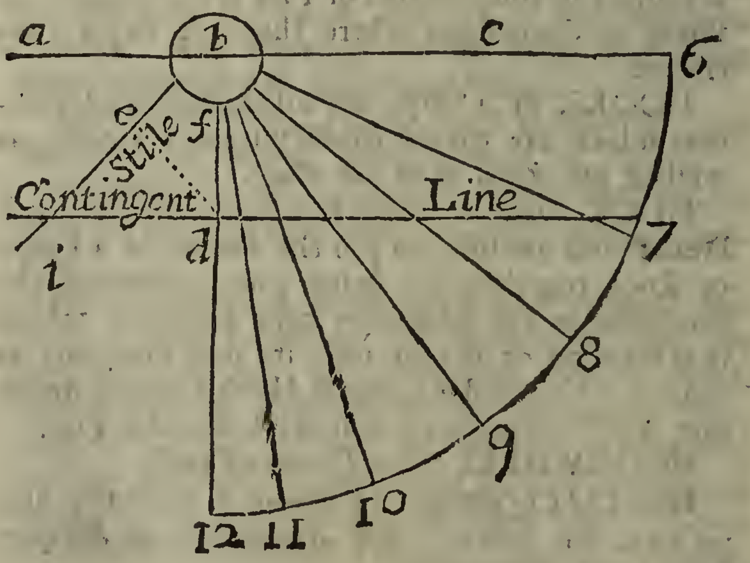


To deſcribe the Dial, Reſpect muſt be had to the Bigneſs of the Plane, and the Place for the Centre *C* determined; and then through *C* draw *C* 12 for the Meridian, (which will alſo be the Subſtilar-Line and Hour-Line of 12) and at Right Angles to it *6 C 6* for the Hour-Line of Six. Then on *C*, with a Line of Chords, whoſe Radius is proper for the Largeneſs of the Dial, draw a Circle, and from *E*, both ways, ſet the ſeveral Diſtances of the Hour-Arks, found by Calculation, in the Circumference of that Circle: Then lay a Ruler to *C*, and draw Lines from thence through all thoſe Diviſions, they will be the true Hour-Lines on the Plane of the Dial.

N. B. *This Practice ſerves to draw an* Erect Vertical Dial; *only in Calculation you muſt uſe the Complement of the Latitude inſtead of the Latitude, and the Hours muſt be numbered differently.*

To draw an Horizontal Dial Geometrically.

Let two Lines be drawn Square-wiſe, *viz. b d* for the Hour of 12, and *b c* for the Hour of 6;



draw the Style *b e* ſo, that the Angle *e b d* may be equal to the Elevation of the Pole; take (where you pleaſe) any Point in the Meridian Line, ſuppoſe *d*, from which, unto the *Style*, let fall a Perpendicular as *d e*, and transfer it into the Meridian in *d f*: Then draw *i d* perpendicular to the Meridian in *d*, for a *Line of Contingence*.

From *f*, as a Centre, deſcribe a Circle repreſenting the Equinoctial at any conſiderable Diſtance, (the bigger the better) and divide it into 24 Parts for Hours, and 48 Parts for half Hours: But it is enough for an Horizontal Dial, if one Quadrant betwixt the Hours of 12 and 6 be divided into 6 Parts or 12.

Make Points in the *Contingent*, where it ſhall be cut by a Ruler applied to the Centre and every Diviſion in the Equinoctial.

Draw the Hour-Lines from the Centre *b*, and every correſpondent Point in the *Contingent*, erecting the *Style* over the *Meridian*, according to the Angle *i b d*.

HORIZONTAL *Line*, any Line drawn parallel to the Horizon upon a Plane: See *Line*.

HORIZONTAL *Parallax*: See *Parallax*.

HORIZONTAL *Projection*: See *Projection*.

HORIZONTAL *Range*, or *Level Range*, of a Piece of Ordnance, is the Line it deſcribes parallel to the Horizon or horizontal Line.

Capt. *Halley*, in *Philoſ. Tranſ.* N. 216. gives two very ready Theorems, the one to find the greateſt horizontal Range at 45 Degrees Elevation, by any Shot made upon any inclined Plane, with any Elevation of the Piece whatſoever; and the other to find Elevations proper to ſtrike a given Object with any Force greater than what ſuffices to reach it with the middle Elevation.

PROP. I.

A Shot being made on an inclined Plane, having the horizontal Diſtance of the Object it ſtrikes, with the Elevation of the Piece, and the Angle at the Gun between the Object and the Perpendicular; To find the greateſt horizontal Range of that Piece, laden with the ſame Charge; that is, half the Latus Rectum *of all the* Parabolæ *made with the ſame* Impetus.

RULE.

Take half the Diſtance of the Object from the *Nadir*, and take the Difference of the given Elevation from that half; the Verſed Sine of that Difference ſubtract from the Verſed Sine of the Diſtance of the Object from the *Zenith*: Then ſhall the Difference of thoſe Verſed Sines: Be to the Sine of the Diſtance of the Object from the *Zenith* :: As the horizontal Diſtance of the Object ſtruck : To the greateſt Range at 45 Degrees.

PROP. II.

Having the greateſt horizontal Range of a Gun, the horizontal Diſtance and Angle of Inclination of an Object to the Perpendicular; To find the two Elevations neceſſary to ſtrike that Object.

RULE.

Half the Diſtance of the Object from the *Nadir*; this half is always equal to the half Sum of the two Elevations ſought: Then ſay, As the greateſt horizontal Range: Is to the horizontal Diſtance of the Object :: So is the Sine of the Angle of Inclination, or Diſtance of the Object from the Perpendicular: To a Fourth Proportional; which Fourth being ſubtracted from the Verſed Sine of the Diſtance of the Object from the *Zenith*, leaves the Verſed Sine of half the Difference of the Elevations ſought; which Elevations are therefore had, by adding and ſubtracting that half the Difference to and from the aforeſaid half Sum.

HORIZONTAL-*Line* [in *Dialling*,] is a Line drawn on any Plane parallel to the Horizon. It is drawn on an Erect or Reclining Plane by a Level; or by applying a Quadrant to the Edge of a Ruler ſo, as that the String and Plummet ſhall cut 00, or 90 Degrees in the Limb.

HORIZONTAL *Plane*, is that which is parallel to the Horizon of the Place; or that is not at all inclined thereto.

HORIZONTAL *Plane*, [in *Perſpective*,] is a Plane parallel to the Horizon, paſſing through the Eye, and cutting the perſpective Plane at right Angles.

HORN [in *Architecture*,] a Term ſometimes us'd for Volute.

HORN *with Horn*, [in *Law*,] a Phraſe us'd when there is Common *per Cauſa de Vicinage*, intercommoning of horned Beaſts.

HORN-GELD, [hoꞃn-ᵹelð, *Sax.*] a Tax to be paid for the feeding of horned Beaſts within a Foreſt.

HORNAGIUM, [in *antient Law Books*,] Hornage, taken to be the ſame as Horngeld.

HORN-WORK, [in *Fortification*,] is an Outwork which advanceth toward the Field, carrying in the Fore-part, or its Head, two Demi-Baſtions in Form of *Horns*. Theſe Horns, Epaulments, or Shouldrings, being joined by a Curtain, ſhut up on the Side by two Wings parallel one to another, are terminated at the Gorge of the Work, and ſo preſent themſelves to the Enemy.

HOROGRAPHY [of ὥρα an hour, and γράφω, Gr. to deſcribe] the Art of making or conſtructing Dials.

HOROLOGIOGRAPHY [of ὡρολογεῖον and γράφω, Gr. to deſcribe] the Art of making *Dials*, *Clocks*, or other Inſtruments, to ſhew the Time of the Day.

HOROMETRY [of ὥρα an hour and μετρέω Gr. to meaſure] the Art of meaſuring or dividing the Hours, and keeping an Account of Time.

HOROPTER, in *Opticks*, is a right Line drawn through the Point of Concourſe, parallel to that which joins the Centre of the Eye.

HOROSCOPE, [of ὥρα and σκοπεῖν, Gr. to view,] a Word in great Requeſt with the Canting Aſtrologers; and ſometimes they put either for a Figure of the Twelve Houſes (as they call the Sines of the Zodiack) erected to tell other Men's Fortunes, and to ſhew their own Folly; or elſe for the Degree of the Aſcendants, or the Star aſcending above the Horizon, at the Time the Queſtion is put, any thing enquired for, or a Native born: But moſt properly *Horoſcope* ſignifies the firſt Houſe or Aſcendant, and is that Part of the Zodiack which is riſing at the Time of the Scheme.

HOROSCOPE, [with *Mathematicians*,] a certain Inſtrument in the manner of a Planiſphere invented by *J. Paduarius*; but now out of Uſe.

HORRIFICA *Febris*, is that Fever in which the Patient is often ſeized with ſhaking Fits and horrible Agonies; 'tis otherwiſe called *Phricodes*: Which ſee. *L. Blanchard.*

HORS *de ſon fee*, is an Exception to avoid an Action brought for Rent, iſſuing out of certain Land by him that pretendeth to be the Lord, or for ſome Cuſtom and Services; for if he can juſtify that the Land is without the Compaſs of his Fee, the Action falls. *F.*

HORSE, is a Rope in a Ship, made faſt to one of the Fore-maſt Shrouds, having a dead Man's Eye at its End, through which the Pendant of the Sprit-ſail Sheets is reeved. Its Uſe is only to keep the Sprit-ſail Sheets clear of the Flukes of the Anchor: alſo he that heaves the Lead out of the Shrouds, has a Rope which is there faſtened to preſerve him from falling into the Sea, which alſo is called a *Horſe*, and ſo alſo is the *Wap* called, which is that whereby the Shrouds are ſet Taught, alſo thoſe little ſhort *Waps* ſeized to the Middle of the Top-maſt and Top-gallant-maſt Stay, wherein are reeved the Top-ſail and Top-gallant-ſail Bowlings, are alſo called *Horſes*.

HORSE [with *Carpenters*,] a Piece of Wood jointed a-croſs two other perpendicular ones to bear up or ſuſtain the Boards, Planks, &c. which make Bridges over ſmall Rivers.

HORSE-SHOE, [in *Fortification*,] is a Work ſometimes of a round, and ſometimes of an oval Figure, raiſed in the Ditch of a Marſhy Place, or in low Grounds, and bordered with a Parapet. It is made to ſecure a Gate, or to ſerve as a Lodgment for Soldiers to prevent Surprizes, or to relieve an over-tedious Defence.

HOSE-HUSK [in *Botany*,] a long, round Huſk within another, as in Pinks, *July* Flowers, &c.

HOSPITALLERS, were the Knights of a Religious Order; ſo call'd, becauſe they built an Hoſpital at *Jeruſalem*, wherein Pilgrims were received. To theſe, when the Templers were ſuppreſs'd by the Council of *Vienne* in *France*, *P. Clement* transferr'd that Order. Their chief Abode is now at *Malta*, and they are call'd *Knights of Malta*. All the Lands and Goods of ſuch as were here in *England* were given to the Crown: See 32 *H.* VIII. *c.* 34.

HOTCHPOT, [in *Law*,] ſignifies a Commixture, or putting together of Lands of ſeveral Tenures, for the equal Diviſion of them: As if a Man, ſeized of thirty Acres of Land in Fee, hath Iſſue two Daughters, and gives with one of his Daughters, to a Man that marries her, ten Acres of the ſame Land in *Frank-marriage*, and dies ſeized of the other twenty Acres: Now if ſhe that is thus married will have any Part of the twenty Acres whereof her Father died ſeized, ſhe muſt put her Lands, given in *Frank-marriage*, in *Hotchpot*; that is, ſhe muſt refuſe to take the ſole Profits of the Lands given in *Frank-marriage*, and ſuffer the Land to be commixt and mingled with the other Land whereof her Father died ſeized; ſo that an equal Diviſion may be made of the whole between her and her Siſter, and thus for her ten Acres ſhall have fifteen, elſe her Siſter will have the whole twenty of which her Father died ſeized.

HOUNDS, in a *Ship*, are Holes in the Cheeks at the Top of the Maſts through which the Ties run to hoiſe the Yards: A Top-maſt hath but one *Hound*.

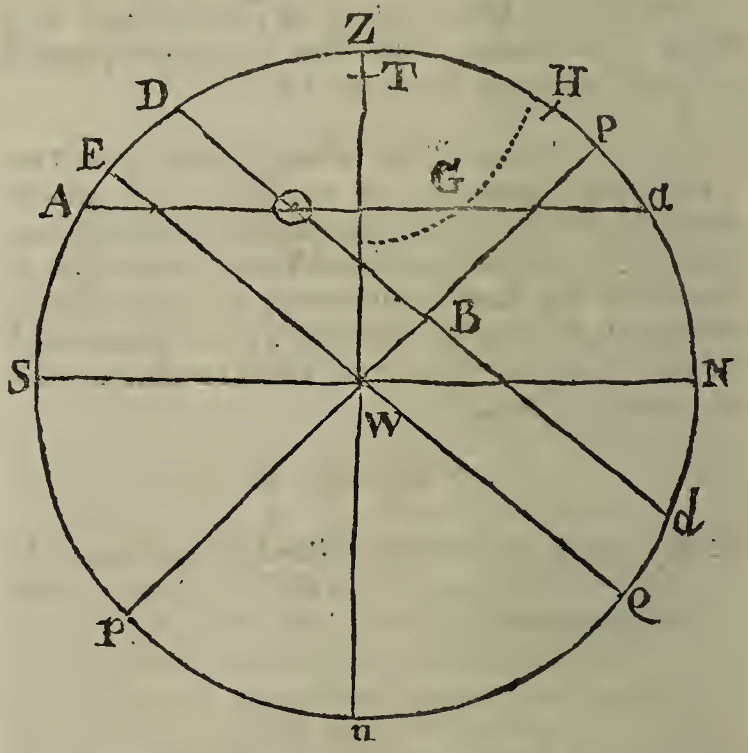
HOUR, is the 24th Part of a Natural Day, containing 60 Minutes, and each Minute 60 Seconds, &c. Theſe are *Aſtronomical Hours*, which always begin at the Meridian, and are reckon'd from Noon to Noon.

But ſome Hours are begun to be accounted from the Horizon, which, when the Account begins at the Sun's Riſing, are called *Babyloniſh Hours*; who begin with the Sun's Riſing, and reckoned on 24 Hours to his Riſing again the next Day.

Others are reckoned after the ſame manner, only begin at the Sun's Setting inſtead of his Riſing; and theſe are called the *Italian* Hours, becauſe the *Italians* account their Time after this Faſhion.

There is yet another Kind of Hours, which are called the *Jewiſh* Hours, becauſe of old the *Jews* accounted their Time this way: Theſe are one 12th Part of the Day and Night, reckoned from the Sun Riſing to Sun Setting, (be the Days or Nights long or ſhort;) and theſe were called, as we find in Holy Scripture, the Firſt, Second, or Third, &c. Hour of the Day or Night.

HOUR *of the Day*. To find this readily by Projection of part of the *Analemma*, proceed thus: With 60 of the Chords draw the Circle *Z S n N* for the Meridian of your Place: Then having given you, as you muſt have, the Latitude of your Place, and the Sun's Declination and Altitude, ſet the firſt of theſe three from *N* to *P*; ſo is *P*, the Pole of the World; draw *P W p* for the Axis. Set next the Latit. alſo from *Z* to *E*, and draw *E W Z* for the Equinoctial. Then ſet the Sun's Declination from *E* to *D*, and from *Q* to *d*, when 'tis North, as here; but on the lower Side of *E Z* when 'tis South; and draw the Parallel of Declination *D d*: Then ſet the Sun's Altitude from *S* to *A*, and from *N* to *a*, draw *A a* for the Almacanter or Parallel of the Sun's Altitude at the Time. The common Interſection of theſe two Parallels in ⊙, will give you the Sun's Place in the Heavens at that Time. And, conſequently, ſetting the Sector to the Radius *D B*, ⊙ *B* will be the Sine of the Hour from 6, either in the Morning or Afternoon. If a Sector be not at hand, you may find the Hour by your Chords, thus: Set the Extent *B D* from *W* to *T*; on which Point *T*, as a Centre, with the Extent *B* ⊙, (the parallel Sine of the Hour from 6) ſtrike the Arch *G*; for then a Ruler laid from *W* juſt to touch the Convexity of the Arch *G*, will cut the Limb in *H*. Then *H N* meaſured on



on the Chords, will give the Degrees of the Hour from 6, which muſt be turned into Time.

HOUR-*Circles*, the ſame with *Meridians*, are great Circles meeting in the Poles of the World, and croſſing the Equinoctial at right Angles: They are ſuppoſed to be drawn thro' every 15th Degree of the Equinoctial and Equator, and on both Globes are ſupplied by the Meridian, Hour-Circle, and Index.

The Planes of the Hour-Circles are perpendicular to the Plane of the Equinoctial, which they divide into 24 equal Parts.

HOUR-*Lines*, on a Dial, ariſe from the Interſection of the Plane of the Dial, with the ſeveral Planes of the Hour-Circles in the Sphere, and therefore muſt be all Right Lines.

To find the Hour of the Day Trigonometrically, having the Latitude of the Place, the Sun's Altitude at Six, and preſent Altitude given.

In *Summer.*

Say, As the Co-ſine of the Latitude : Is to the Difference of the Sines of the Altitude at Six, and preſent Altitude : :
So is the Radius : To the Sine of the Hour from Six.

In *Winter.*

Say, As the Co-ſine of the Latitude : Is to the Sum of the Sines of the Altitude at Six, and preſent Altitude : :
So is the Radius : To the Sine of the Hour from Six.

To find the Hour of the Day, having the Co-Latitude of the Place = 38 Degrees 30 Minutes.

The Sun's Co-Altitude = 60 Degrees, and his Co-Declination = 76 Degrees 53 Minutes.

Proceed and ſet all Things thus:

Co-Latitude 38° 30′ $\left\{\begin{matrix}\text{whoſe Compl.}\\ \text{Arithm. Sine}\end{matrix}\right\}$ = 0.205853
Co-Declinat. 76 53 $\left\{\begin{matrix}\text{whoſe Compl.}\\ \text{Arithm. Sine}\end{matrix}\right\}$ = 0.011481

Difference 38 23
Co-Altitude 60 00

Sum 98 23
Difference 21 37

Half Sum 49 11 Sine 9.878984
Half Differ. 10 48 Sine 9.272726

Sum of all the 4 Sines 19.379044

Their half Sum 9.689522

Which laſt Logarithm is the Sine of 29 Degrees 17 Minutes, and this doubled, gives 58 Degrees, 17 Minutes; and then converted into Time, gives 38 Hours 51 Minutes, and ſo much did it want of Noon then; that is, 'twas 8 a-Clock, and 9 Minutes before Noon.

HOUR-*Scale :* On one of the Edges of *Collin*'s Quadrant there is uſually an Hour-Scale (as on the other Edge is a Line of Latitudes) which is no other than a double Tangent, or two Lines of Tangents, each of 45 Degrees, ſet together in the middle; and ſo might, if there were need, be continued *in infinitum.*

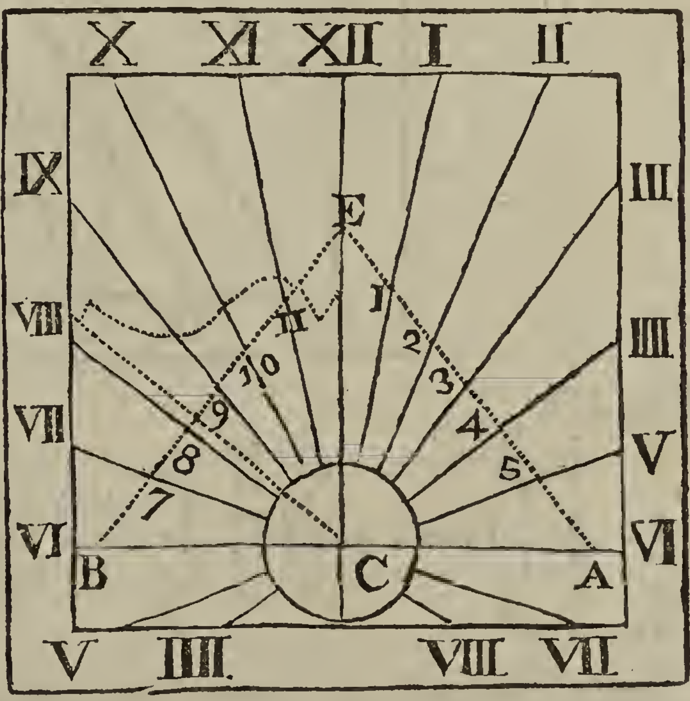
And on the other Face of this Quadrant there is alſo an Hour-Scale of another kind; being 62 Degrees of a Line of Sines, whoſe Radius is made equal to half the *Secant* of the Latitude (being fitted for *London)* to the Common Radius of the Sines. Againſt it, and running by it, is a prick'd Line of Declinations: To the Sun's greateſt Declination is alſo a Portion of the Line of Sines, whoſe Radius is equal to the Sine of the Latitude of *London*, taken out of the other part of the Scale.

Theſe *Hour-Scales* (eſpecially the former) may be put on any Ruler, Sector, *&c.* and will ſerve for theſe Uſes.

The firſt *Hour Scale*, or Double Tangent, is a Scale of Six Hours; and by help of the Line of Latitudes, (which ſhould be always placed by it) will ſerve very readily and univerſally to prick down all Dials that have Centres; after this manner.

I. *To draw an Horizontal, or a Direct Erect South Dial.*

Draw firſt the Right-Line *C E* for the Hour-Line of 12, and croſs it in *C* (which will be the Centre of the Dial) with the Perpendicular *B A:* Then from the Scale of Latitudes take off the Latitude of the Place for an Horizontal (or the *Co-Latitude*, for a Direct South and Vertical) Dial, and ſet it with your Compaſſes each way from *C* to *A* and *B:* Then take with your Compaſſes the whole *Hour-Scale*, and ſetting the End of it at *A* and *B*, and its Beginning at *E*, transfer it, and all its Diviſions (or ſuch as you ſhall have occaſion for at leaſt) on each ſide from *A* to *E*, and from *B* to *E*, making the *Iſoſceles* Triangle *B E A:* Then numbring the Diviſions with the proper Hours, as you ſee in the Figure, Right Lines drawn from *C*, through thoſe Hours, Halves, or Quarters, in the prick'd Lines *A E* and *B E*, ſhall be the true Hour-Lines of the Dial: and to the Dial you may give what Form or Figure you pleaſe.



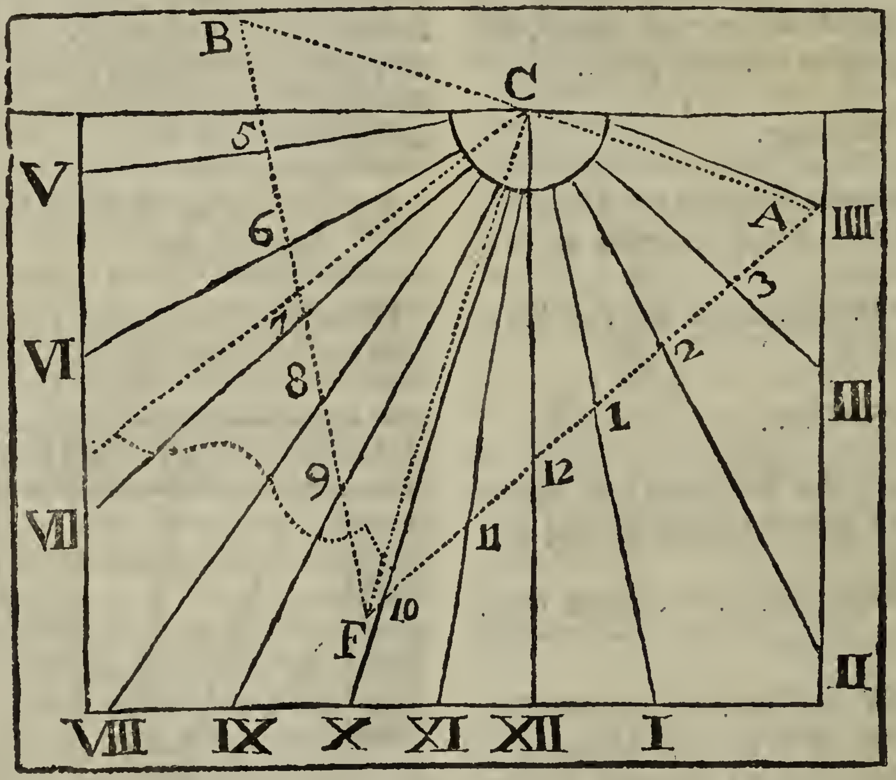
II. *To draw an upright Declining Dial.*

Suppoſe for the Latitude of *London* 51°. 30′ and declining Eaſtwards 25°. You muſt firſt, either

ther by Calculation, or by *Collin*'s Dialling-Scales, &c. find the Requiſites of your Declining Dial; which will be theſe:

The Subſtile's Diſtance from the Meridian will be	18°. 34'.
The Angle of the Hour-Lines of 12 and 6 will be	62°. 00'.
The Angle of the Inclination of Meridians will be	30°. 47'.
And the Style's Height will be an Angle of	34°. 19'.

Being thus prepared, you may then draw the Line VIII, II, as the true horizontal Line of your deſign'd Dial, and then to it, at right Angles, the Line XII *C* for the Meridian. Next make the Angle *FC* XII equal to 18°. 34'. the Subſtile's Diſtance from the Meridian; and by the Chords prick off *F C* for the Subſtile. To which in *C*, the Centre of the Dial, draw the Perpendicular *B A*: Then make *C A* and *C B* equal to the Style's Height 34°. 19'. (taking it in your Compaſſes from the Line of Latitudes;) and then apply the whole Scale of Hours (as before in the horizontal Dial) on each ſide *C F*, from *A* to *F*, and from *B* to *F*. Next get the *Difference* between 30°. 47'. the proper Inclination of Meridians, and the next Hour's Diſtance from the Meridian that is leſs than that Angle; which in this Caſe is 10, or 30°. from 12. This Difference will be found here to be 47'. or, in Time, nearly 3 Minutes. The fitting the Scale of Hours, was before taught from *A* to *B*; count upon the ſaid Scale.



Hours	*Min.*		
0	3	From *F* to	10
1	3		11
2	3		12
3	3		1
4	3		2
5	3		3

And make Points at the Terminations with a Pin or Pen: And draw Lines from thoſe Points to the Centre *C*; and they ſhall be the true Hour-Lines on this Side the Subſtile.

Again, Fitting in the Scale of Hours from *B* to *F*, count from the End at *B*, the former Ark of Time.

Hours	*Min.*		
0	3	From *B* to	4
1	3		5
2	3		6
3	3		7
4	3		8
5	3		9

And make Points at the Terminations, as before; through which draw Lines to the Centre, and they ſhall be the Hour-Lines on the othe Side the Subſtile.

The like muſt be done for the Halves, Quarters, &c. getting the Difference between the Half-hour next leſs (in this Example 22° 30'.) under the Ark called the Inclination of Meridians, the Difference is 1°. 17' (in Time nearly 33'.) to be continually augmented an Hour at a time, and ſo prick'd off as before was done for the whole Hours.

If the Scale of Hours reach above the Plane, as in this Caſe at *B*; ſo that *B C* cannot be prick'd down: Then may an Angle be laid down on the upper ſide of the Subſtile, equal to *F C A* on the under ſide, and thereby the Scale of Hours laid in its true Situation, having firſt found the Point *F* on the under ſide.

The Stile may be eaſily laid down by the Chords*, or a* Protractor*. And if your Scales are large and carefully made, as this is one of the eaſieſt, ſo 'tis as exact a Way of drawing Dials as any whatſoever.*

HOUSE, [in *Aſtrology*,] a twelfth part of the Heavens: The Diviſion of the Heavens into Houſes is made by ſix great Circles, call'd *Circles of Poſition*, which cut each other in the common Interſection of the Meridian and Horizon, in the common

mon way of domifying, *i. e.* that of *Regiomontanus.* This Diviſion of the Heaven into Houſes is founded on this, That when the Planets and Stars are found in them, they are ſuppos'd to have certain Influences, either good or bad, upon ſublunary Bodies, and they aſſign its particular Virtue or Influence to each *Houſe*; upon Conſideration of which they draw their Horoſcope.

Theſe *Circles of Poſition* divide the Equator into twelve equal Parts, without any regard had to the Zodiack.

The Horizon and Meridian are two Circles of the Celeſtial Houſes, which divide the Heavens into four equal Parts, each of which comprehends three Houſes. There are ſix above the Horizon, and ſix below it: Six Eaſtern, and ſix Weſtern ones.

The Figure of the Heavens alſo conſiſts of twelve Triangles, which are alſo call'd *Houſes*, in which the Stars, Signs and Planets compriz'd within the reſpective Spaces of theſe Circles, are laid down.

Theſe Houſes have their particular Names, according to their imaginary Qualities. The firſt is the *Houſe of Life*; this is the Aſcendant, and contains five Degrees above the Horizon; the reſt beneath it. The ſecond is the *Houſe of Riches*: The third the *Houſe of Brothers.* The fourth, in the loweſt Part of Heaven, the *Houſe of Relations*, and Angle of the Earth. The fifth, the *Houſe of Children.* The ſixth the *Houſe of Health.* The ſeventh the *Houſe of Marriage*, and the Angle of the Weſt. The eighth the *Houſe of Death*, and the upper Gate. The ninth the *Houſe of Piety.* The tenth the *Houſe of Offices.* The eleventh the *Houſe of Friends.* And the twelfth the *Houſe of Fortune.*

HOUSEBOTE, the ſame with *Eſtovers*, or an Allowance of neceſſary Timber out of the Lord's Wood, for the Repair and Support of a Houſe or Tenement.

HOUSED-IN, the Seamen ſay of a Ship, which, after the Breadth of her Bearing, is brought in too narrow to her upper Works, that ſhe is *Houſed-in* or *Pinched-in* too much.

HOWKER, or *Houcre*, is a Veſſel much uſed by the *Dutch*; built ſomething like a Pink, but Maſted and Rigg'd like a Hoy. They carry from 50 to 200 Tun: And with a ſmall Number of Hands will go to the *Eaſt-Indies.* They Tack ſoon and ſhort; will Sail well, and lie near the Wind; and will live almoſt in any Sea.

HOWL: When the Foot-hooks of a Ship are ſcarfed into the Ground-Timbers and boulted, and then the Plank laid on them up to the Orlop, the Carpenters ſay, they begin to make the Ship *howl.*

HOY, is a ſmall Veſſel or Bark, whoſe Yards are not a-croſs, nor the Sails ſquare like thoſe of Ships; but her Sails are like a Miſſen, and ſo ſhe can lie nearer the Wind than a Veſſel with croſs Sails can do: A *Ketch* is a ſmaller Veſſel of this Kind.

HOYSE, is the Sea Word for haling up any thing into the Ship for getting up a Yard, *&c.* Thus they ſay, *Hoiſe* up the Yard! *Hoiſe* the Water in! *&c.*

HUE-AND-CRY: *Manwood*, in *Foreſt Law*, c. 19. *Num.* 11. ſaith, That *Hue* ſignifies the Complaint of the Party, and *Cry* is the Purſuit of the Felon upon the High-way upon that Complaint; for if the Party robbed, or any in the Company of one robbed or murdered come to the Conſtable of the next Town, and will him to raiſe the *Hue-and-Cry*, (that is, make the Complaint known, and follow the Purſuit) after the Offender, deſcribing the Party, and ſhewing, as near he can, which way he went; the Conſtable ought forthwith to call upon the Pariſh for Aid in ſeeking the Felon; and if he be not found there, then to give the next Conſtable Notice, and the next, until he be apprehended, or at leaſt, until he be thus purſued unto the Sea-ſide.

HULKS, are large Veſſels, having their Gun-Decks from 113 to 150 Foot long, and from 31 to 40 Foot broad. They will carry from 400 to 1001 Tons. But their chiefeſt Uſe is for ſetting in Maſts into Ships, and the like. Though antiently the Word *Hulka* ſeems to ſignify a ſmall Veſſel.

HULL *of a Ship*, is her Main Body, without any Maſts, Yards, Sails, or Rigging.

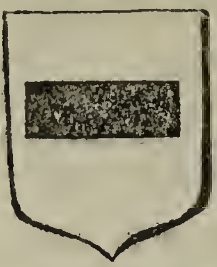
To *Hull*, or lie a *Hull*, is ſpoken of a Ship, when either in a dead Calm (to preſerve her from beating her Sails againſt the Maſts) or in a Storm when ſhe can't carry 'em, all her Sails are taken in to preſerve them, ſo that nothing but her *bare Poles*, her Maſts, Yards, and Rigging, are abroad; this is called *hulling*; her Helm is tied down to the Lee-ſide of the Ship, and then, if ſhe be a good Sailor, ſhe will lie eaſily under the Sea, and make her way one Point before the *Beam.*

HULLOCK *of a Sail*, is when in a great Storm ſome ſmall Part of a Sail is cut and left looſe: It's chiefly uſed in the Miſſen-ſail, to keep the Ship's Head to the Sea, then all the reſt of the Sail is made up, except a little at the Miſſen-yard Arm: Alſo when a Ship will not *Weather-Coyl*, to lay her Head the other way, they looſe a *Hullock* of her Fore-ſails; and then changing the Helm to the Weather-ſide, ſhe is then made to fall off, and to lay her Head where her Stern lay before.

HUMANITIES, [*Literæ humaniores*, L.] the Study of the *Greek* and *Latin* Tongues, Grammar, Rhetorick, Poetry and the antient Poets, Orators, Hiſtorians, *&c.*

HUMECTATION, is the moiſtening of any mixt Thing, in order to prepare it for ſome Operation, or that its beſt or fineſt Parts may the better be extracted: Thus *Agarick*, *&c.* are moiſtened while they are pounding, leſt they ſhould exhale too faſt; and *Caſſia* is moiſtened, the better to extract its Pulp. *L.*

HUMERUS, the Shoulder-bone, being the firſt Bone of the Arm; 'tis long and round, its Subſtance or Fibres are pretty ſolid and compact; it has a wide and long Cavity in its Middle, in which is contained its Marrow. At its upper-end it has a round Head covered with a Cartilage, which is received into the Cavity of the Neck of the *Scapula*; but becauſe this Head is much larger than the Cavity, therefore it is ſurrounded with a ſtrong Ligament, which riſes from the Edge of the Cavity of the *Scapula.* At its lower End it has two Protuberances; the one External, which receives the Extremity of the *Radius*; the other Internal, which is received into the Semi-circular *Sinus* of the *Ulna*: On the Fore-ſide of this Protuberance there is a ſmall *Sinus*, which receives the fore Proceſs of the *Ulna*; and on the back-ſide there is another large *Sinus*, which receives the *Olecranium.* There is another ſmall Protuberance on the Side of this, from which the Muſcles that lie on the Inſide of the Arm ariſe.



HUMID. *Bloom*, in his Heraldry, gives you a *Feſſe* of this Form, which he calls *Feſſe humid.*

HUMIDITY, is the Quality which we call Moiſture, or the Power of wetting others, which ſome Liquors and Fluids are endowed with. This differs very much from *Fluidity*, as you may ſee under that Word; and ſeems to be merely a relative thing depending on the Congruity of the Component Particles of the Liquor, to the Pores of ſuch particular Bodies as it is capable of adhering to, penetrating a little into, or wetting.

Thus, for Inſtance, Quickſilver is not a moiſt Liquor, as to our Hands or Cloaths; but may be called ſo in reference to Gold, Tin, or Lead, to whoſe Surfaces it will preſently adhere. Now even Water it ſelf that wets almoſt every thing, and is the great Standard of Moiſture and Humidity, is not capable, as it appears, of wetting every thing; for it ſtands, and runs eaſily off in globular Drops on the Leaves of Cabbages and many other Plants, and will not wet the Feathers of Ducks, Swans, and other Water-Fowl, as it will other Things. And that Texture only may cauſe a Fluid to be *humid*, is plain from hence, That though neither Quickſilver alone, Lead, or Biſmuth will adhere to Glaſs; yet being mixed together, they will form a Maſs that will do ſo; as is plain from ſuch a Compoſition being frequently uſed to foliate Looking-Glaſſes. Vid. *Mr.* Boyle*'s Hiſtory of Fluids and Firmneſs*, Pag. 187.

HUMIDUM *Radicale*, [with *Phyſicians*,] the Radical Moiſture, which ſeems to be nothing elſe but the pureſt and moſt delicate Part of the nutritious Matter, in a Condition ready to be aſſimilated.

HUMILIS: See *Deprimens*.

HUMOURS. The Antients made four *Humours* in the Blood, the Bilous, Pituitous, (Yellow and Black Choler) Melancholick, and the Blood, properly ſo called, and that according to the four Peripatetick Elements: But this Opinion is caſhier'd, ſince the Invention of the Circulation of the Blood; yet they are found when the Blood preternaturally departs from its due Temperature; but they do not conſtitute an integral Part of the Blood, for the Blood is only one Humour; if otherwiſe, Tartar in Wine, and Dregs in Beer, were conſtituent Parts of Wine and Beer. In Blood that is let, there appear only three different *Species* of Bodies; for in the Surface you ſee a Kind of a Fibrous Cruſt of coagulated Blood, which ſpreads it ſelf over the whole Maſs; then you ſee certain red Particles amongſt the Fibres, which grow black about the Bottom by reaſon of their Fewneſs: Laſtly, you ſee the *Serum* wherein it ſwims. But if any one will proceed more accurately, diſtil the Blood, and diſſolve it Chymically, he ſhall find five pure Bodies in it; to wit, Spirit, Sulphur or Oil, Water, Salt, and Earth.

There are three general *Humours* which waſh the whole Body, Blood, *Lympha*, (a ſort of pure Water) and the Nervous Juice; but there are ſeveral particular *Humours*, as Chyle, Bile, Spittle, Pancreatick Juice, Seed, *&c.*

There are alſo *Humours* in the three Membranes that cloath the *Fœtus* in the Womb, which are three in thoſe Animals that have Bladders: At the Beginning, when the Egg falls down from the *Ovaria* into the Womb, the *Humours* which are to this Purpoſe in the Bottom of the Womb, firſt ſink into the Membrane called *Chorion*, and then into the *Amnion*; but in Proceſs of Time, when the *Fœtus* is formed, and the Navel-Veſſels are extended to the *Chorion* and the *Amnion*, we imagine that the Nutritious Humour, being received by the Opening of the Veins, is carried to the *Fœtus*, and thence, by the Arteries, ſome Part of it is carried into the *Amnion*, as into the Child's Store-houſe; ſo that at the ſaid time the Liquor of the *Membrane Amnion* may be increaſed upon this double Account. *Blanchard.*

At laſt, when the Time of Delivery draws near, that way of Sweating through ſeems to ceaſe, and the others only take Place; unleſs (as *Wharton* writes) the Nutritious Humour deſcend from the *Placenta* by the Navel-String, and by the little ſoft Protuberances, thence paſs into the Cavity of the *Amnion*: The Uſe of theſe *Humours* is to nouriſh the *Fœtus* at the Mouth.

The Third *Humour* is the Urine, which flows from the Bladder by the Urinary Paſſage, into the Urinary Membrane.

HUMOURS *of the Eye*, are Three: The *Watery* or *Aqueous*, which is contained between the *Tunica Cornea* and *Uvea*.

2. The *Cryſtalline* or *Icy Humour*, which is contained in the *Tunica Uvea*, and is thicker than the reſt.

3. The *Vitrious* or *Glaſſy Humour*, bigger than any of the reſt, fills the backward Cavity of the Eye.

The *Aqueous Humour* ſerves to moiſten and levigate the two other denſer *Humours*, as alſo the *Tunica Uvea* and *Retina*, and perhaps (ſaith *Diemerbroeck*) to nouriſh them too: When this fails, grows dreggy, or too thick, the Sight preſently grows dull and imperfect. If it be ſo dreggy as that pretty large Particles are formed, and ſwim about in it, the Perſon fancies he ſees Flies and Motes always before his Eyes; and if theſe Particles grow altogether in a Film or Membrane, and ſo come to cover the Pupil, 'tis called a *Suffuſion*, which is the beginning of a *Cataract*.

The *Vitrious Humour*, ſome ſay, ſerves to dilate the Rays which it receives from the *Cryſtalline*, and to bring them to the *Retina*; or, as others think, it helps to collect the Rays refracted by the *Cryſtalline* into one Point, that the Viſion may be the more diſtinct and vivid.

The *Cryſtalline Humour*, which ſome call *Glacialis*, is the primary Inſtrument of Viſion, in reſpect of its Collecting and Reception of the Rays, which come hither, dilated by the *Aqueous Humour*, are collected and conveyed to the *Retina*.

HUNDRED, is a Part of a Shire or County, properly ſo called, becauſe it contained Ten *Decennæ* or *Tythings*: And either becauſe at firſt there were an hundred Families in each Hundred; or elſe that the Hundred found a hundred Men for the King's Wars. Theſe Hundreds were firſt ordain'd by King *Alfred*, the 29th King of the *Weſt Saxons*; and he took the way of doing it from *Germany*; where *Centa*, or *Centena*, is a Juriſdiction over an hundred Towns. Hence you ſee the Original of *Hundreds*, which ſtill keep the Name, and remain, in ſome ſort, the ſame, as to their Service in ſeveral Reſpects: But their Juriſdiction is transferr'd to the County-Court; ſome few excepted,

cepted, which have been by Privilege annex'd to the Crown, or granted to ſome great Subject, and ſo remain ſtill in the nature of a Franchiſe: And this hath been ever ſince the Statute of 14 *Edw.* III. 1. *c.* 9. whereby theſe Hundred-Courts, formerly Farm'd out by the Sheriffs to other Men, were reduc'd all, or moſt of them, to the County-Court; and ſo remain at preſent. Where-ever therefore we meet with the Word Hundred-Court now, it ſignifies ſome Franchiſe, where the Sheriff does not intermeddle by his ordinary Authority, unleſs when they of the Hundred refuſe to do their Duty.

HUNDRED-*Courts*, were held antiently by the *Hundredarius*, or Chief-Conſtable, of every Hundred, for better Support of his Office. Theſe Courts were held in ſome Places once in three Weeks, and in others once a Month. And by Stat. 14. *Edw.* III. theſe Hundred-Courts were reduc'd to the County-Courts; tho' in ſome few Hundreds the Old Franchiſes are ſtill remaining.

HUNDREDERS, are Men Empanelled, or fit to be Empanelled, on a Jury, upon a Controverſy; and who dwell in the Hundred where the Land in queſtion lies. But

HUNDREDARIUS, the *Hundreder*, is he that hath the Juriſdiction of a Hundred, and who holdeth the Hundred-Court. And ſometimes 'tis uſed for the Bailiff of the Hundred.

HUNDREDI *Secta*, was the Payment of perſonal Attendance, ordering Suit and Service at the Hundred-Court.

HUNDREDUS *Affirmatus*, was the Profits of an Hundred-Court, Firmed or Farmed out for a ſtanding Rent.

HUNDRED-LAGH, [hundꞃeð-laᵹa, *Saxon* Law,] the Hundred-Court, from which all the King's Foreſt were freed by the Charter of King *Canutus*.

HURDLES, or *Clays*, [in *Fortification*,] are made of thick and ſmall Twigs of Willows or Oſiers, being five or ſix Foot high, and from three to four Foot broad. They are interwoven very cloſe together, and uſually laden with Earth, that they may ſerve to render Batteries firm, or to conſolidate the Paſſage over muddy Ditches; or to cover Traverſes and Lodgments for the Defence of the Workmen, againſt the artificial Fires or Stones that may be caſt upon them.

HURRICAN, is a moſt furious and dreadful Storm of Wind, which the *Caribbe-Iſlands*, and ſome other Parts of the *Indies*, are ſubject to: Its Extent and Continuance is but ſmall, but its Violence prodigious.

HURTS, a Term in *Blazonry*: See *Balls*.

HUSEBOTE, was formerly the Liberty a Tenant had to cut as much Wood on the Premiſſes as was neceſſary for the Support and Repair of the Farm-Houſe and adjoining Buildings. This is now call'd *Eſtovers*, *Eſtoverium*.

HUSTINGS, a Court held before the Lord-Mayor and Aldermen of *London*; an Error or Attaint lies there of a Judgment or falſe Verdict in the Sheriff's-Court.

HYADES, [Ὑάδες of ὕειν, Gr. to rain,] a Conſtellation call'd the Seven Stars, famous among the Poets for bringing Rain.

HYALOIDES, [ὑαλοειδὴς, Gr.] is the Vitreous Humour of the Eye, contained betwixt the *Tunica Retina* and the *Uvea*.

HYBERNAL *Occident*: See *Occident*.

HYBERNAL *Orient*: See *Orient*.

HYBOMA, [ὕβωμα, Gr.] is an Incurvation of all the Vertebres.

HYDATIDES, [ὑδατίδες, Gr.] are little Watery Bladders in the Liver, Spleen, or ſome other *Viſcus*, common to hydropical Perſons: But Dr. *Tyſon* ſuppoſes them to be a *Species* of Worms, or imperfect Animals.

HYDATIS, [ὑδατὶς, Gr.] a Diſeaſe of the Eyes, that conſiſts of a fatty Subſtance or Excreſcence, growing under the Skin of the upper Eye-lid; by which, in Children, the whole Eye-lid is rendred œdematous: alſo a little Bladder of Water, occaſionally found in divers Parts of the Body.

HYDATOIDES, [ὑδατοειδὲς of ὕδωρ, Water, and εἶδος, Gr. form,] is the Watery Humour of the Eye, contained betwixt the *Tunica Cornea* and *Uvea*.

HYDE-*Land*: See *Hide-Land*.

HYDRA, a Southern Conſtellation, conſiſting of 26 Stars, and imagined to repreſent a *Water-Serpent*.

HYDRAGIA: See *Venæ Lymphaticæ*.

HYDRAGOGUES, [ὑδραγωγὰ of ὕδωρ Water, and ἀγωγὸς, Gr. a Leader,] are Medicines which, by Fermentation and Precipitation, purge out the Watery Humours.

The Antients thought this was done by ſome peculiar Texture, and that thence its Virtue aroſe to purge away Seroſities or Watery Humours only.

HYDRAULICS, [ὑδραυλικὰ of ὕδωρ and αὐλὸς, Gr. a Pipe,] the Art of making all Sorts of Engines to carry or raiſe Water, or which are moved by Water, and ſerve for other Uſes. The Word ſignifies Sound made by Water, becauſe when Organs were firſt found out, they were blown by the Fall of Water inſtead of Bellows.

You have many antient Water-Engines deſcribed by *Hiron*, and which are called *Machinæ Hydraulicæ*. *Athenæus* attributes the Invention of the Water-Organ to *Cteſibius*; but others ſay *Plato* firſt found out the ſounding *Clepſydra*, which told the Hour of the Night by the Noiſe of Pipes blown by the Air forced by the Fall of the Water. Mr. *Ozonam* confounds this Word with *Hydroſtaticks*.

HYDRAULO-PNEUMATICAL *Engines*, [of ὑδραυλικὸς and πνευματικὸς, Gr.] are ſuch as raiſe Water by means of the Spring (either Natural or Forced) of the Air.

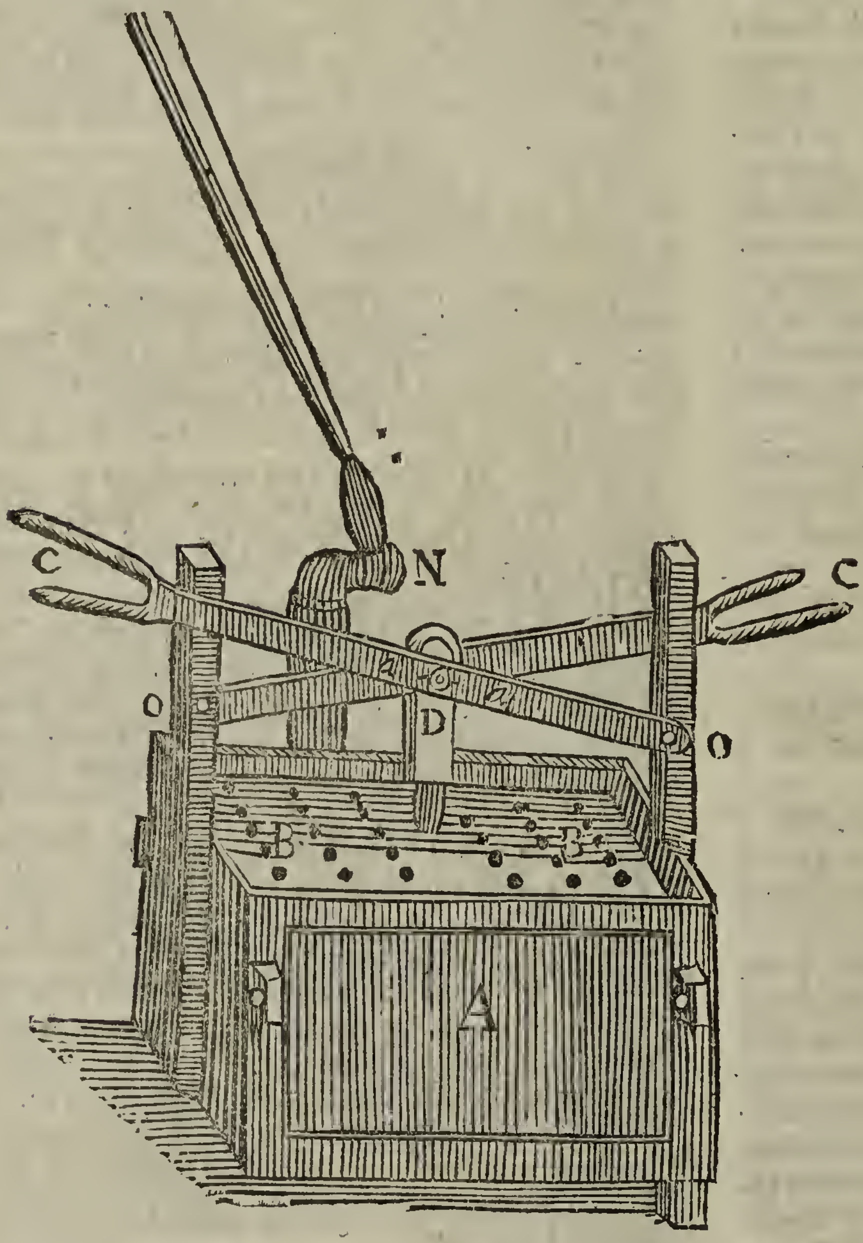
The Honourable Mr. *Boyle* mentions a very pretty Fountain, which he calls *Hydraulo-Pneumatical*, and which was made by the Spring of the Air preſſing up Water in a Pipe, when in the Exhauſted Receiver the Weight of the Atmoſphere was taken off: See *Continuation of Phyſico-Mechanical Experiments*, Exper. 4.

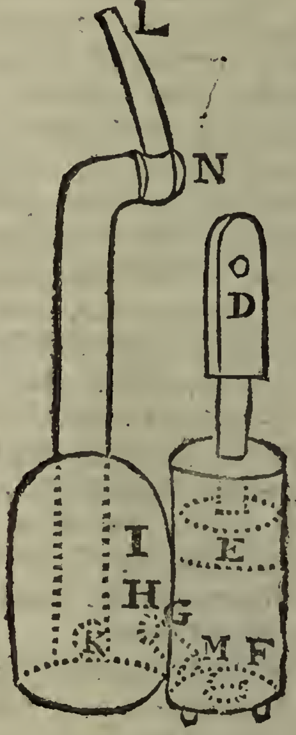
And you may eaſily try the Thing, if you fill but any middle ſiz'd Vial about half full of Water; and then, with Sealing-Wax or Cement, faſten in its Neck a long ſlender Glaſs Pipe, (a Piece of Tobacco-pipe or Quill will do) one of whoſe Ends ſhall be below the Surface of the Water in the Glaſs; for then, if the Mouth of the Bottle be accurately ſtop'd, the Warmth of your Hand only will ſo increaſe the Spring of the included Air, that it will make the Water riſe up, and run out at the Top of the Pipe; and if you blow ſtrongly in at the Top, and force a good Quantity of Air into the Bottle, the Spring of the Air ſo forced in, will, on the Removal of your Mouth, drive the Water up the Pipe with a great Force; and if the Orifice be very ſlender, or the Cavity of the Pipe very ſmall, it will make the Water imitate an artificial Fountain, which will keep running for near half a Minute.

A Deſcription of the Common Hydraulick Engine *uſed to quench Fire*, &c. *from* Philoſoph. Tranſ. Numb. 128.

The Engine is a Cheſt of Copper, as *A*, tranſportable by means of two wooden Bars, like a Sedan or Chair. This Cheſt is pierced with many Holes above *B B*, and holds within it the Body of a Pump *E F M*, whoſe Sucker *D E* is raiſed and abaſed by two Leavers *C O*: Theſe Leavers have each of them two Arms, and each Arm being fitted to be laid hold on by both Hands of a Man. Each Leaver is pierced in the Middle by a Mortiſe *a a*, in which an Iron Nail, which paſſes through the Handle of the Sucker, turns round when that Sucker is raiſed or lowered.

Near the Body of the Pump there is a Copper-Pot *I H K*, join'd to it by the Tube *G*; and having another Tube *K N L*, which in *N* may be turned every way.





To make this Engine play, Water is poured upon the Cheſt, to enter in at the Holes that are in the Cover thereof: This Water is drawn into this Body of the Pump at the Hole *F*, at the Time when the Sucker is raiſed; and when the ſame is let down, the Valve of the ſame Hole *F* ſhuts, and forces the Water to paſs thro' the Hole: For in the Tube *G*, of which the Valve *H* being lifted up, the Water enters into the Pot, and filling the Bottom, it enters thro' the Hole *K* into the Tube *K N L*, in ſuch a manner, that when the Water is higher than the Tube *K N L*, and the Hole of the Tube *G* is ſhut by the Valve *H*, the Air incloſed in the Pot hath no Iſſue; and it comes to paſs, that when you continue to make the Water enter into the Pot by the Tube *G*, which is much thicker than the Apperture of the End *L*, at which it muſt iſſue, it muſt needs be, that the Surplus of the Water that enters into the Pot, and exceeds that which at the ſame time iſſues through the ſmall End of the Jet, compreſſes the Air to find Place in the Pot, which makes that, whilſt the Sucker is rais'd again, to make new Water by the Force of its Spring, mean time that a new Compreſſion of the Sucker makes new Water to enter, and cauſes alſo a new Compreſſion of Air: And thus the Courſe of the Water which iſſues by the Jet, is always entertained in the ſame State, becauſe that proportionably, as the Impulſe is ſtrong, the Water entring faſter, and conſequently in greater Quantity into the Pot, makes a greater Compreſſion of the Air, which, the more ſtrongly it is compreſs'd and penn'd in, returns alſo with the greater Force into its Native State, by means of its Spring, and therefore throws out the Water with greater Force.

HYDROA, [ὑδρῶα of ὑδρόω, Gr. to ſweat,] are certain little, broad, moiſt, itching Pimples, like Millet-ſeed; ſometimes without itching, which render the Skin ulcerous and rough; tho' to expel the Sweat by the Skin, is hindred ſometimes by its Thickneſs; ſo that the Matter being lodged there, and the ſubtiler Parts being either carried back by the Lymphatick Veſſels, or evaporated, the Skin ſwells. This Diſtemper is familiar and common to Boys and young Men, eſpecially of a hot Conſtitution, when they uſe too much Exerciſe in Summer: It infects the Neck, Shoulder-blades, Breaſts, Arms, Thighs, yet more frequently the Secret Parts and the Fundament. *Blanchard.*

HYDROCELE, [ὑδροκήλη, Gr.] is a Swelling of the outermoſt Skin in the *Scrotum*, proceeding from a Watery Humour. *Blanchard.*

HYDROCEPHALOS, [ὑδροκεφαλος of ὕδωρ and κεφαλος, Gr. the Head,] is a Swelling of the Head, by reaſon of a watery Humour; whence the Sutures of the Brain are forced aſunder; it proceeds ſometimes from a Burſting of the Lymphatick Veſſels. *Blanchard.*

HYDROENTEROCELE, [of ὕδωρ Water, ἔντερον an Entrail, and κήλη a Burſtneſs, Gr.] is a Falling of the Inteſtines, together with Water, into the *Scrotum*. *Blanchard.*

HYDROGRAPHICAL *Charts*, are certain Sea Maps, delineated for the Uſe of Pilots and other Mariners; wherein are mrrk'd all the Rhumbs or Points of the Compaſs and Meridians parallel to one another, with the Shelves, Shallows, Rocks, Capes, &c.

HYDROGRAPHY, [ὑδρογραφία of ὕδωρ and γραφὴ, Gr. a Deſcription,] is an Art which teacheth how to deſcribe and meaſure the Sea; giving an Account of its Tides, Counter-Tides, Soundings, Bays, Gulphs, Creeks, &c. As alſo the Rocks, Shelves, Sands, Shallows, Promontories, Harbours, Diſtance from one Port to another, and other Things remarkable on the Coaſts.

HYDROMANCY, [ὑδρομαντεία of ὕδωρ and μαντεία, Gr. Divination,] a pretended Divination by Water.

HYDROMEL, [ὑδρόμελι, Gr.] Mead, is a Decoction of Water and Honey.

HYDROMETER [of ὕδωρ Water, and μέτρον, Gr. Meaſure,] an Inſtrument for meaſuring the Gravity, Denſity, Velocity, Force, or other Property or Circumſtance of Water.

HYDROMETRIA, [Ὑδρομετρία, Gr.] the Art of meaſuring Water and other Fluid Bodies, to find their Gravity, Force, Velocity, Quantity, &c. It includes both *Hydroſtaticks* and *Hydraulicks*.

HYDROMPHALUS, [ὑδρόμφαλον of ὕδωρ and ὄμφαλος, Gr. a Navel,] a Tumour in the Navel, ariſing from a Collection of Water.

HYDROPHOBIA, [ὑδροφοβία of ὕδωρ and φόβος, Gr. Fear,] is a Diſtemper highly Convulſive, accompanied with Fury, and ſhunning of all Things that are Liquids and Splendid; ſometimes with a *Delirium*, a Fever, and other Symptoms, and not without great Danger of Life, proceeding from the Bite of a mad Dog, or a Contagion analogous to it.

In *Philoſoph. Tranſact. N.* 147. there is an Inſtance of one having this Diſeaſe, occaſioned by the Bite of a mad Dog.

HYDROPICA, [ὑδρωπικὰ, Gr.] are Medicines that expel the Watery Humour in a Dropſy.

HYDROPS, [ὕδρωψ, Gr.] a Stagnation of the Watery Humour in the Habit of the Body, or ſome Cavity of it: And it is either General, as an *Anaſarca*, and *Aſcites*; to which ſome add a Tympany, but ill: Or Particular, confined to one Part, as a Dropſy in the Head, Breaſts, Hand, Foot, &c. *Blanchard.*

HYDROPS *ad Matulam*, the ſame with *Diabetes*. L.

HYDROSTATICAL *Ballance*, a kind of Ballance contriv'd for the eaſy and exact finding the ſpecifick Gravity of Bodies, either liquid or ſolid.

HYDROSTATICKS, [ὑδροστατικὰ of ὕδωρ and στατικὴ of στατέω, Gr. to weigh,] is that Part of Staticks which relates to the Gravities and *Æquilibria* of Liquors; and alſo comprehends the Art of Weighing Bodies in Water, or ſome other proper Liquor, thereby to eſtimate their Specifick Gravity; and to deduce thence many other uſeful Theorems.

And *this* (as is obſerved by the Honourable Mr. *Boyle*) is a Part of Philoſophy which ought to be looked upon as the moſt ingenious of any: The Theorems and Problems of this Art, being handſome Productions of Reaſon, and affording Diſcoveries, not only pleaſing, but alſo ſurprizing and wonderful: Nay, very many of the moſt familiar, as well as moſt abſtruſe *Phænomena* of Nature, can hardly ever be throughly underſtood without Hydroſtatical Principles. 'Tis an Art alſo not only delightfully Speculative, but practically Uſeful: It may be of the higheſt Importance to Shipping and Navigation, to thoſe that deal in Salt-works, and to thoſe whoſe Buſineſs 'tis to enquire into the Gravities and Magnitudes of ſome Bodies; the exact Knowledge of which would very much conduce to their Intereſt. But of the great Uſefulneſs of this Art, ſee more under *Specifick Gravity*.

And that Admirable Gentleman, the Honourable Mr. *R. Boyle*, conſidering that all Perſons are not acquainted with, and cannot readily digeſt rigid Mathematical Demonſtrations, that it might be of great Advantage to prove the Truth of ſuch uſeful Propoſitions, as thoſe given us by Hydroſtatical Writers, in a Senſible and Phyſical way: As alſo, That ſome Things before paſſing for receiv'd Truths, would then be diſcover'd to be palpable Errors, as well as many Noble and Uſeful Diſcoveries this way communicated to the World:

Conſidering this, I ſay, That Noble Author reduced the chiefeſt of the Hydroſtatical Theorems into the following Paradoxes; which you will ſee he made clearly out by Experiment and ſenſible Proof.

Though before he comes to them he thinks fit to premiſe theſe Things as *Poſtulata* or *Lemmata*.

1. That if a Pipe, or Tube, open'd at both Ends, and placed perpendicularly to the Horizon, have its lower Orifice under Water, there will paſs an imaginary Plane or Surface parallel, as to Senſe, to the upper Surface of the Water, which ſhall touch that lower Orifice of the Tube.

2. That each Part of this Surface or Plane will be alike preſſed (if at all) by the Weight of the perpendicularly incumbent Water, which cannot but be granted, ſince the Water being ſuppoſed an homogeneous Fluid of equal Gravity every where, and equally high above the aforeſaid Plane, there can no reaſon be aſſign'd why any one Part of it ſhould be more or leſs preſſed than any other.

3. That though in this Caſe the Liquor will keep its former Poſition, yet if any one Part of it comes to have a greater Weight incumbent on it than another, then that Part will be diſplaced and depreſſed;

as is the Caſe when a Stone or other Body, ſpecifically heavier than Water, ſinks down in it, and tends to the Bottom.

For in what Part ſoever of the Water the Stone is, that Part being more preſſed upon than the reſt, muſt yield and give way to the Motion of the Stone downward, till it come to the Bottom.

And on the other hand, if any Part of this imaginary Surface be leſs preſſed upon than the reſt, it muſt, by the greater Preſſure of the reſt, be impelled upwards, 'till it have an Height equivalent to balance the Preſſure made on the other Parts of the Water; which latter Part will appear highly reaſonable and grantable by any attentive Conſiderer.

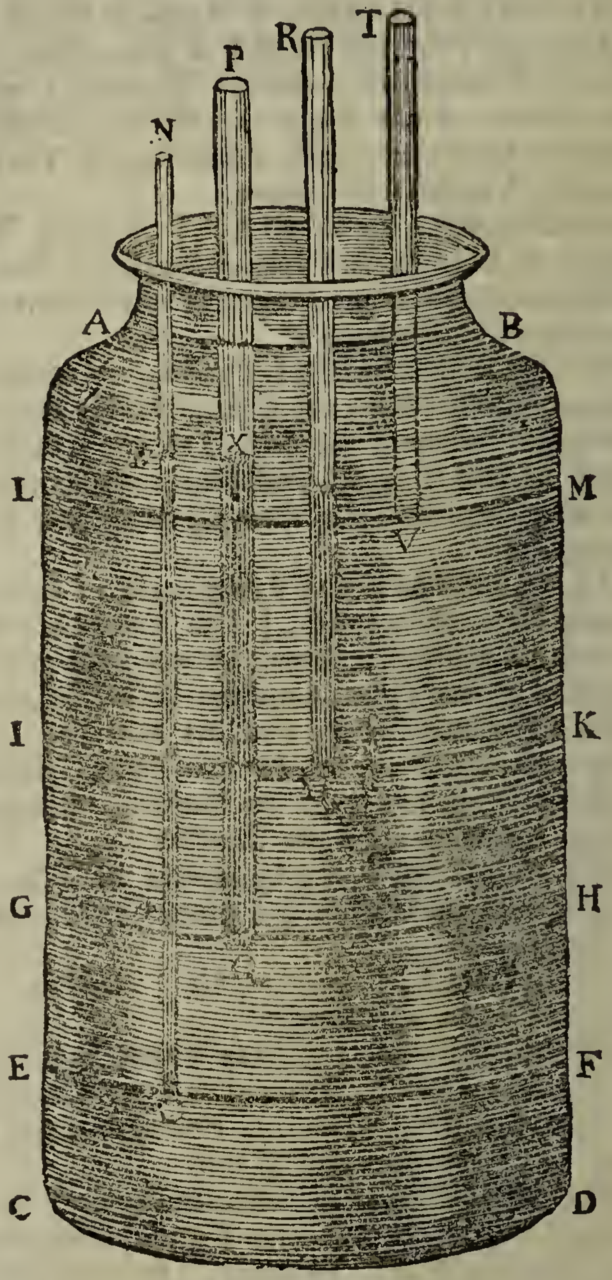
And its Truth in Fact he proves by this Experiment:

If a ſmall Tube, open at both Ends, be held or placed perpendicularly a little beneath the Surface of the Water, in any Veſſel; [Note, *'Tis beſt to uſe one of Glaſs, that the Experiment may be the more viſible*;] then will the Water riſe in the Tube as high and a little higher (for a Reaſon which you will find given hereafter) than the Surface of the Water without: But if you gently pour Oil of Turpentine, or any other Liquor which will not mix with Water, upon that contained in the Veſſel, you will ſee, that as the Oil grows higher and higher on the Surface of the Water, and preſſes conſequently more and more upon it, ſo will the Water riſe within the Orifice of the Tube, and deſcend again proportionably as you take off the Oil; which plainly proves, That the Weight of the Oil preſſing more on the Surface of the Water without the Tube, than the bare Air only can do within it, forces up the Water ſo high in the Tube, till the Cylinder of Water within the Tube, doth as much gravitate on that Part of the Water under the Orifice of the Tube, as the Air, Oil and Water together do on all the others, without it.

PARADOX I.

That the Upper Parts of all Fluids, as Water, &c. do preſs upon the Lower.

Provide a Glaſs Jarr, near of the Shape in the Figure annexed; (though a long Drinking-glaſs, like that uſed for Mum, may do well enough.) Fill it with Water near full, as up to *A B*: Then take a ſmall Glaſs Pipe or Tube, open at both Ends, and dipping the lower End into Oil of Turpentine, you may, by ſtopping the Top with your Finger, ſuſpend as much of the Oil as you pleaſe in the Tube: This done, move the Tube into the Glaſs of Water, and thruſt it down till the upper Surface of the Oil in the Tube, be near as low as the upper Surface of the Water: And when you take your Finger from the Top of the Tube, you will ſee the Oil will not run out at the lower Orifice of the Tube. Nay, if you thruſt the Tube lower down into the Water, that Liquor will riſe up into the Tube, and bear the Oil above it; but if you raiſe the Tube up, ſo that the upper Surface of the Oil in it be higher conſiderably than that of the Water, the Oil will drop out of the Tube, and riſe up to the Top of the Water. The Reaſon of which is this: When the imaginary Surface *G H*, on which the End *Q* of the Tube *P Q* leans, is as much, and no more, preſſed upon by the Oil in the Pipe, than the other Parts of that Surface are by the Parts of the Water perpendicularly incumbent on them, there is an *Æquilibrium* between the Oil and the Water, and ſo the Oil cannot run out; and when you ſink the Tube down as low as *O*, the incumbent Water doth more gravitate on the Surface or Plane *E F*, than the Oil in the Tube doth on the Part under it; and conſequently the Water will be forced up into the Tube, and will bear the Oil above it; and the Water will riſe ſo high, as that the Water and Oil together, in the Tube *N O*, do gravitate as much on the Surface *E F*, as the other incumbent Parts of the external Water do: But if you raiſe the Tube up into the Poſition *R S*, the Oil in it preſſing more on the imaginary Surface *I K*, than the incumbent Water doth on any other Part of it, the Oil muſt run out, till ſo much deſcend out of the Tube, as will bring the Gravity of the Oil to an *Æquilibrium* with that of the Water. All which plainly prove the Truth of the Paradox or Propoſition, *That the Upper Parts of all Fluids, do gravitate or preſs upon the Lower.* For if you try the Experiment with any two other Liquors, which will not mingle one with another, it will ſucceed; provided the Bore of the Pipe be not too large.

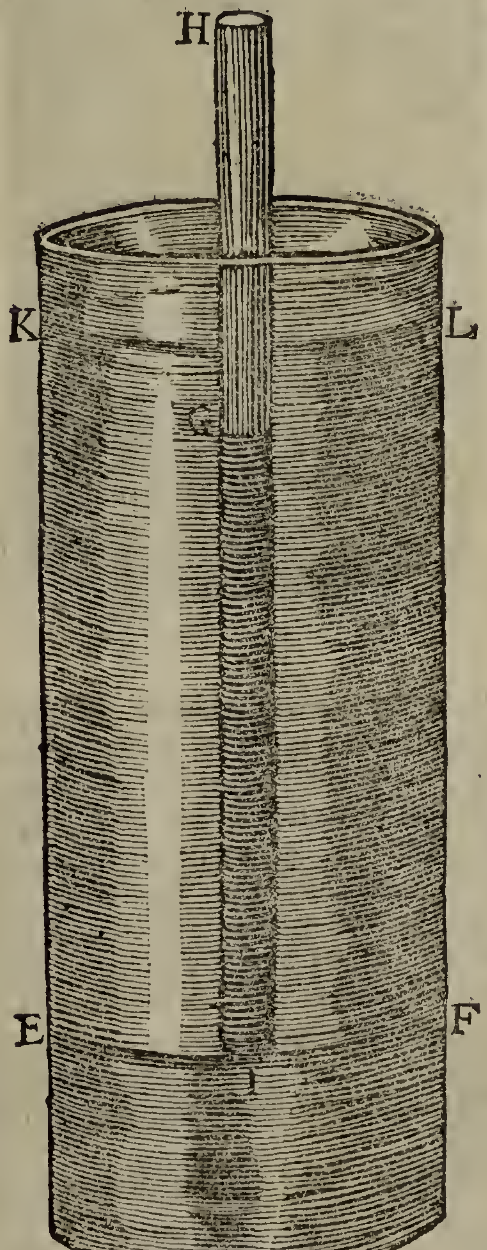


PARA-

PARADOX II.

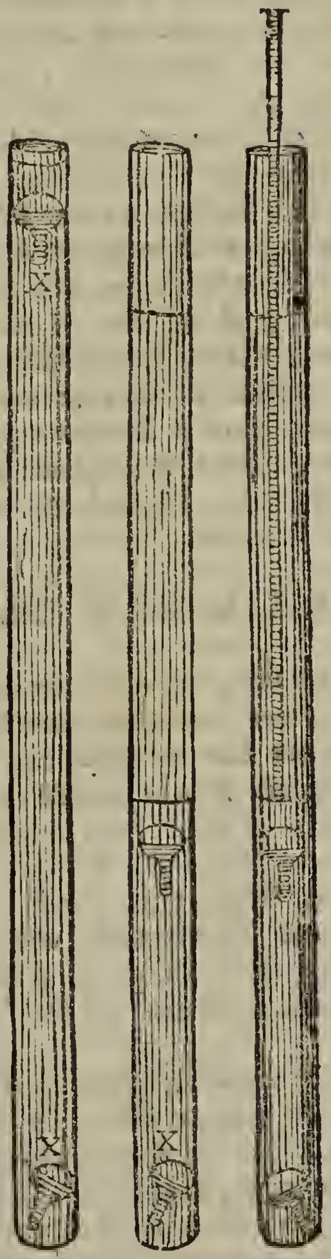
That a lighter Fluid may gravitate or preſs upon a heavier.

Fill the former Jarr with Oil of Turpentine, inſtead of Water, and then place in it a Tube of the ſame Bore as the former, in which you ſhall have ſuſpended a Column of Water, as before you had of Oil: And you will find that though the Water be heavier than Oil of Turpentine, yet if you do not take your Finger from the upper Orifice till ſuch time as you have ſunk the Pipe ſo low as that the upper Surface of the Water in it be a little below the Surface of the Oil in the Glaſs; I ſay, that then on taking off your Finger, you will find the Water in the Pipe will not run out: That if you ſink the Tube lower, or pour more Oil into the Veſſel, the Oil will riſe up in its Lower End; and that if you raiſe it higher, the Water will run or drop out, and fall to the Bottom of the Veſſel. Which plainly ſhews, That a Liquor lighter in *Specie*, may buoy up and keep ſuſpended one that is heavier; and the Reaſons are in effect the ſame as thoſe given for the Solution of the Phænomena of the Firſt Paradox; the only Difference being, that the Oil and the Water have changed Places, the Oil now being in the Jarr, and the Water in the Tube.



This Second Paradox our Author alſo very ingeniouſly illuſtrates and confirms by the following Experiment.

Into a long Glaſs Pipe, ſealed at one End, and whoſe Bore was about half an Inch in Diameter, he poured a Quantity of Water; and then having a ſmall Glaſs Bubble about the Bigneſs of a Pea, with a very ſmall and ſlender Stem, as you ſee in the Figure annexed; which Bubble was ſo exactly poiſed, by forcing Water into it, that tho' it would not ſink in a Veſſel of Water, yet a very little more Weight would make it do ſo.



This Bubble being put into the Glaſs Pipe, did ſwim on the Top of the Water contained in it; but when he poured Oil of Turpentine (very gently, to prevent confounding the two Liquors) on the Water in the Pipe, and that till it had attained a convenient Height above the Surface of the Water, he found that the Bubble, which before ſwam on the Surface of the Water, did now ſink down to the Bottom, and ſtay there as long as the Oil was kept upon the Water; but if either the Tube was very much inclined any way, or if the Oil, by a Siphon or otherwiſe, were drawn off, the Bubble would then emerge to the Top.

The Reaſon of which Phænomenon he truly ſtates to be this, That when the Oil was poured on, that did (though a lighter Fluid by its proper Gravity) preſs on the Water on which it was incumbent, and by that means did force ſome of it to enter in at the little Stem of the Bubble; which, by that means being rendred in the whole more heavy, did ſink to the Bottom: But when the perpendicular Preſſure of the Oil upon the Water was taken off, by inclining the Tube, or removed by drawing off the Oil quite, the Air in the Bubble, which before was compreſt, did now by its Spring force out the newly admitted Water again, and ſo reduce the Bubble to its former Degree of Gravity, ſo that it would be ſuſpended in the Water as before.

He found alſo, that pouring on *more Water* would produce the ſame Phænomenon, if, by a Wire, he firſt thruſt down to, and then kept at the Bottom of the Tube, the aforeſaid poiſed Bubble; for though it would readily emerge on the removal of the Rod or Wire, when no more Water was poured into the Tube, yet, that if the Wire kept the Bubble at the Bottom till he had poured in more Water, to about two or three Foot high, into the Pipe, the Bubble would then, on the removal of the Wire, ſtay there, and not riſe at all, till the ſame Quantity of Water was taken out which was before added: Which Experiment doth Nobly Illuſtrate and Prove his firſt Propoſition, *That the upper Parts of the ſame Fluid, do preſs or gravitate on the lower.*

PARADOX III.

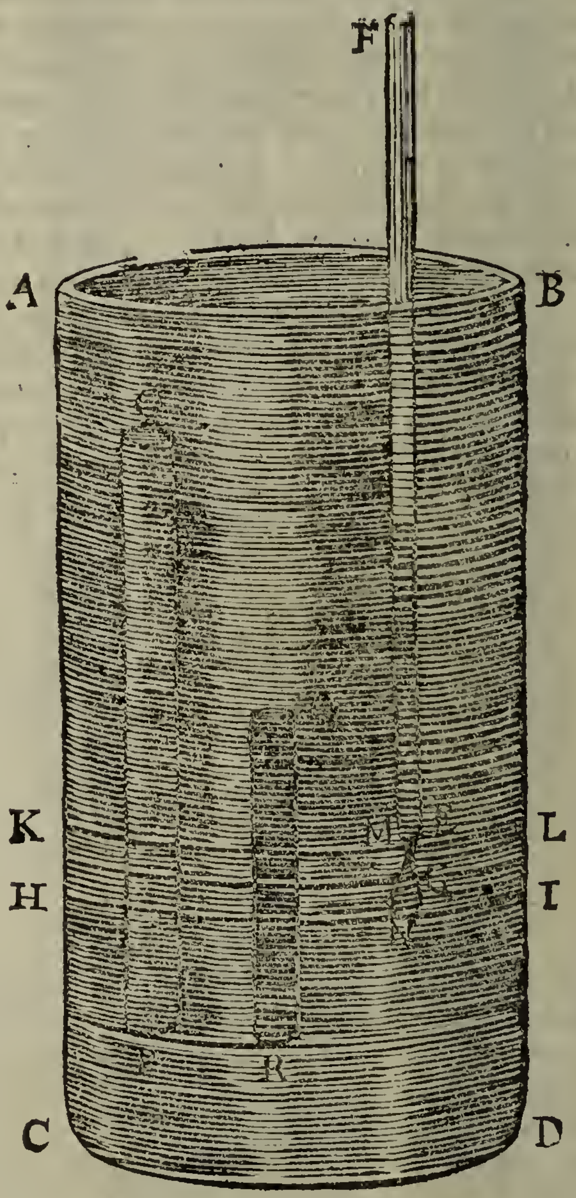
If a Body contiguous to the Water be altogether, or in Parts, lower than the upper Surface of the Water, the lower Part of the Body will be preſſed upward by the Water which toucheth it beneath.

This appears from the *Firſt Experiment*, where the Oil of Turpentine was kept in an open Tube from deſcending, or running out of it, by the Preſſure upwards of the Water on its lower Parts.

And by the *Second Paradox* it appears, that Oil, a lighter Fluid, could preſs upwards, or keep Water, a Fluid in *Specie* heavier than it, ſuſpended in an open Pipe.

But in order to eſtimate how much the Preſſure of the Water againſt the lower Parts of any Body doth amount to, let us ſuppoſe a Parcel of Oil, heavier than Water, as ſuppoſe that of Cinnamon, Cloves, Guaiacum, *&c.* were taken up into a Tube, and then that Tube were, as in the former manner, immerſed into a Veſſel of Water, and there placed ſo ſhallow, that the Oil, on removing of the Finger from the Top of the Tube, would drop out. The Drop *G*, being heavier in Specie than Water, would (by *Lemma* 3.) ſink to the Bottom, but not ſo quickly as it would in the Air; and ſince, if it were of a Matter equi-ponderant to Water, 'tis plain it could not ſink at all, any more than emerge; it doth now ſink by no greater a Degree of Gravity, than that by which it ſurmounts a Quantity of Water equal to it in Bulk: And therefore *it will loſe in the Water juſt as much of the Weight it would have in the Air, as ſo much Water as is equal to it in Bulk, if weighed in the Air alſo, would amount to*; which is a Phyſical Demonſtration of the *Grand Theorem of Hydroſtaticks*, firſt put in a clear Light by our Noble Author Mr. *Boyle.*

The Preſſure of Water alſo againſt the lower Parts of any immerſed Body, is confirmed by attending to the *Reaſon* why any Body lighter in Specie than Water, doth emerge out of it; which is this, That there is a greater Preſſure or Weight on every other Part of the imaginary Surface of the Water (as ſuppoſe *I K* in *Fig.* 1.) than there is on that, on which the emerging or riſing Body leans; and conſequently to produce an *Æquilibrium* in the Fluid, the Parts Immediately under the riſing Body being preſſed by the reſt every way, muſt continually force it upwards, till it attain the upper Surface of the Water: For the emerging Body is continually preſſed upon by two Columns of Water, one bearing againſt its upper, and the other againſt the lower Parts; the Length of both which Columns being to be accounted from the Top of the Water, that which preſſes on the lower Part, will be the longer by the Thickneſs of the aſcending Body, and conſequently over-balance it by the Weight of as much Water as will fill the Space that Body takes up: Wherefore the greater Diſparity there is between the Specifick Gravities of Water and the emerging Body, and the larger the Particles are that emerge, the ſwifter will they aſcend.



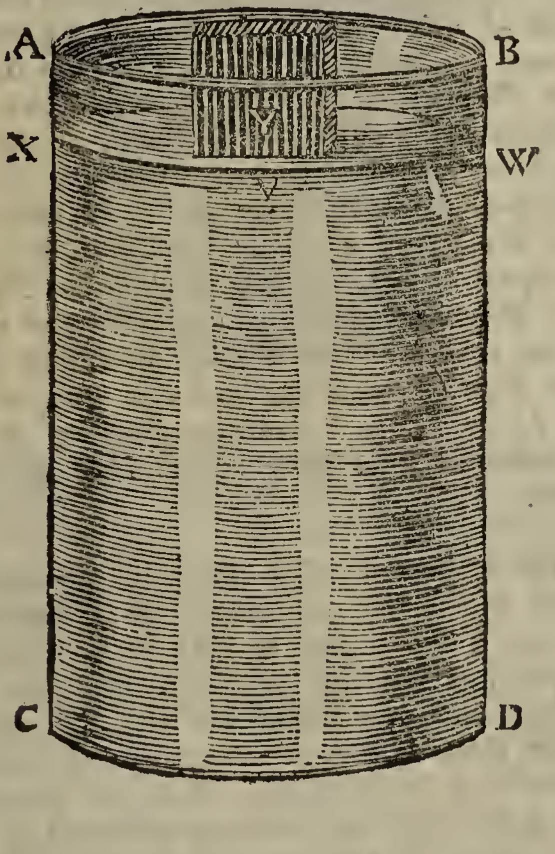
And this will help us to account for theſe Things.

1. For the Reaſon of that Experiment, That if two Pieces of a Stick of the ſame Bigneſs, but

of unequal Length, as *O P*, and *Q R*, are permitted to riſe from the Bottom of a Veſſel of Water at the ſame time, the longeſt will come firſt to the Top, which muſt be becauſe the Columns of Water which preſs againſt the lower Ends of both, being equal, but that ſhorter which preſſes on the upper End of the longer Piece, it muſt be leſs preſſed downwards than the other, and ſo by the general Preſſure upwards will riſe faſteſt.

2. From hence we may eaſily conceive one Reaſon, (for I aſſert not that 'tis the only one) why very minute Corpuſcles, either higher or heavier in Specie than the Liquor they are mingled with, may be kept there a good while without emerging to the Top, or precipitating to the Bottom: For their Thickneſs being indefinitely made ſmall, the Difference between the two Columns before mentioned, will be ſo too, and conſequently either of them can very little over-balance the other.

3. We may from hence account for the Quantity of that Part of any Floating Body which is beneath the Surface of the Water, *which is always in Bulk equal to as much Water as the whole Floating Body doth weigh:* For this Floating Body doth by its lower Part preſs on the ſubjacent Parts of the imaginary Surface of the Water *XW*, juſt as much as the Columns of Water to the Altitude *A X* or *B W* do on all other Parts; that is, juſt as much as the Water would do if it were in the Space which the Part immerſed takes up, or as much as a Quantity of Water equal in Bulk to the immerſed Part would do.



And from hence 'tis clear, That the Weight of that mighty Ship, the *Royal Sovereign*, is the ſame with that of ſo much Water as is in Bulk equal to the immerſed Part of her, or to that Part of her Hull which is underneath the Surface of the Sea. Which Aſſertion Mr. *Boyle* found accurately enough to hold true by the following Experiment:

A broad ſhallow Veſſel of Glaſs being near filled with Water, he placed floating in it a Glaſs Tumbler or ſhort Drinking Glaſs; and to make it a little reſemble a Ship, he fitted a Wooden Deck, with a Maſt, &c. to it; and then he ſunk it by ballaſting it with Sand, and made it draw as much Water (as the Seamen ſay) as he thought fit: Then did he, by accurate Marks, diſtinguiſh how high the Water in the containing Glaſs did riſe on the Sides of the Veſſel: This done, he took the Tumbler out, wiped it dry, and weighed it, and then found a Quantity of Water exactly equal to that Weight; which Water, when put into the broad Glaſs, roſe up to thoſe Marks exactly which he had before obſerved the Tumbler had raiſed the Water to.

PARADOX IV.

That to account for the raiſing of Water in Pumps, &c. there needs only the competent Weight of an External Fluid.

Take up in a ſlender Glaſs Tube about an Inch in height of any deeply tinged Liquor (ſuch as an Infuſion of Brazil-Wood and Cochineel, &c. in Water, for elſe the Phænomena will not be conſpicuous) and then ſtopping the upper End with your Finger, place it in a Glaſs Veſſel filled with the ſame tinged Liquor, and that ſo low, that the upper Surface of the Liquor in the Tube be at leaſt an Inch below that of the Liquor of the Veſſel: Then pour on Oil of Turpentine for about three or four Inches Height above the Water in the Veſſel, and you will ſee, on the removal of your Finger from the Top of the Tube, that the tinged Water will be raiſed or impelled upward near as high as the Surface of the Oil.

Now here no *abhorrence of a Vacuum* can be pretended, as the Cauſe of the Aſcent of the Water, for the Tube is full of Air, and the External Air hath a free Ingreſs into it: But the plain Reaſon is this, That there being a greater Preſſure made by the Oil and Water together on the imaginary Plane that paſſes by the lower Orifice of the Tube without the Tube, than within it, (for within there is a Preſſure only of an Inch of Water, and of a Column of Air) the Parts of the Water at the Bottom of the Pipe muſt be thruſt upwards into it, till it riſe ſo high as to gain an *Æquilibrium* with the reſt.

And this will eaſily account for the Aſcent of the Water in the Pumps:

Where the External Air preſſing every where on the Surface of the Water in the Well, but not on that within the Pump, becauſe 'tis taken off by the Sucker; which is therefore with ſoft Leather, &c. made ſtanch on purpoſe.

On the raiſing therefore of the Sucker, the Water muſt follow it (if the Pump be good) becauſe the Weight of the whole Atmoſphere preſſes on the Surface of the Water in the Well, (but not at all within the Body of the Pump) and ſo raiſes or forces it up into the Cavity of the Pump. And that this Preſſure of the Air is the Cauſe of the Waters Riſe, is more than probable, becauſe no Pump can ever raiſe Water above 33 or 34 Foot; which is found to be exactly agreeable to the different Gravities of Air and Water, allowing for the great Height of the Atmoſphere: *Of which more elſewhere.*

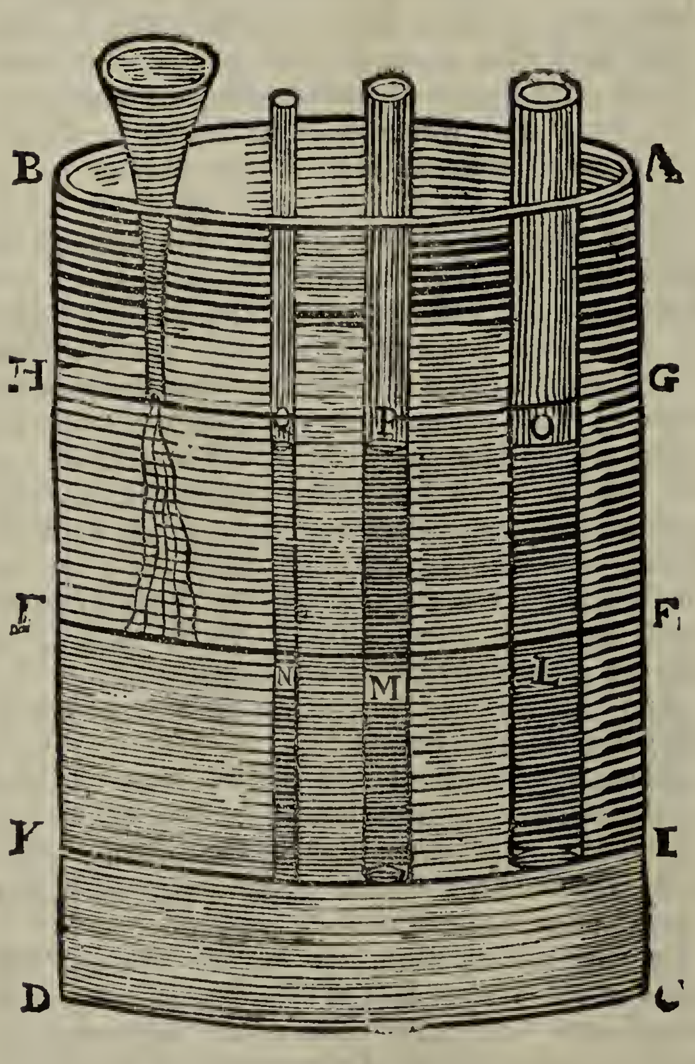
PARADOX V.

That the Preſſure of an External Fluid, is able to keep an Heterogeneous Liquor ſuſpended at the ſame Height in ſeveral Pipes, though they be of different Diameters.

Take a pretty wide-mouth'd Glaſs, (as in *Fig.* 5. following) of a convenient Depth, and put into it a ſufficient Quantity of Water well tinged with Brazil, *&c.* then fit to it a Cover of Cork, through which bore, with a red-hot taper Iron, ſeveral round Holes, to admit Tubes of different Bigneſſes or Sizes. Let theſe Tubes ſtand nearly upright in the Veſſel, and reach all with their lower Orifices below the Surface of the Water: Then at an Hole purpoſely left for it, pour in gently, by a Glaſs Funnel, a good Quantity of Oil of Turpentine, and you will plainly ſee the tinged Water riſe equally, (*i. e.* to equal Heights) in all the Tubes, tho' of very different Bores and Sizes.

The Reaſon of which will thus appear.

Let *E F* repreſent the Surface of the Water in the Veſſel; when the Oil comes to be poured upon it, not being of a Nature fit to mingle or incorporate with it, it will ſwim at the Top, and with an equal Gravity preſs upon all Parts of the Surface of the Water, and conſequently will raiſe or preſs up the Water in the Tubes, till it come near to the ſame Height in them, as the Oil is at in the Glaſs, to bring the Liquors to a Balance. But there is no Reaſon why the Water ſhould be raiſed to a greater Height in any one Tube than in another; becauſe the Oil preſſes uniformly and equally on all Parts of the Surface of the Water; and conſequently can force up the Water no higher in the ſmalleſt Tube than in the greateſt; for ſhould it do ſo, the Water in the ſmall Tube muſt be of a larger Length than the correſponding Column of Oil (whoſe Diameter is equal to the Orifice of that Tube, and which keeps it up by equi-ponderating with it) doth require: But then it muſt be heavier than it, and ſo would ſink down, and drive the ſubjacent Water away to make room for its Deſcent: Wherefore no Cylinder of Water in any Tube, can be higher than an equal Cylinder of Oil that bears or buoys it up; and this being the Caſe with them all, they muſt be all of the ſame Height; that is, the Water will riſe as high in one Tube as in another, be their Bores never ſo different; and the Reaſon is, becauſe each one is born up by a correſponding Column or Cylinder of Oil, whoſe Diameter is the ſame, with that of the Orifice of the Tube.



PARADOX VI.

If a Body be placed under Water, with its uppermoſt Surface parallel to the Horizon, the direct preſſure *which it ſuſtains, is no more than that of a Column of Water, having the Horizontal Superficies of the Body for its Baſe, and the Perpendicular Depth of the Water for its Height. And if the Water that leans on the Body be contained in Pipes open at both Ends, the Preſſure of the Water is to be eſtimated by the Weight of a Pillar of Water, whoſe Baſe is equal to the lower Orifice of the Pipe, and its Height equal to a Perpendicular reaching from thence to the Top of the Water; though the Pipe be much inclined any way, or though it be never ſo irregularly ſhaped; and much broader in ſome other Places than at the Bottom.*

Take a ſlender Glaſs Pipe of an even Bore, turned up at one End like this in the Figure; dip this Tube (open at both Ends) into Oil of Turpentine, till the Liquor be riſen up to two or three Inches in the longer Leg, whoſe upper Orifice then ſtop with your Finger; and then remove the Tube into a Glaſs of Water, and hold it ſo that the Surface of the Oil in the longer Leg of the Pipe be but a very little higher than that of the Water: And then, if you take away your Finger that ſtopt the Pipe, you will ſee the Oil will keep its Station, and not at all, or at leaſt but very little, riſe or fall; but if you ſink the Tube lower, the Oil will riſe; if you raiſe the Tube higher, the Oil will run out at the lower End: From whence it appears, That of all the Water in the Glaſs, no more preſſed on the Orifice of the Pipe, than a Cylinder equal to it in Diameter, and in Length equal to the Diſtance between the Orifice of the Pipe and the Top of the Water, (as you may alſo eaſily find if you make a Siphon, whoſe ſhorter Leg ſhall be long enough to contain ſuch a Cylinder of Water as will counterpoiſe the Oil in the longer.) For when,

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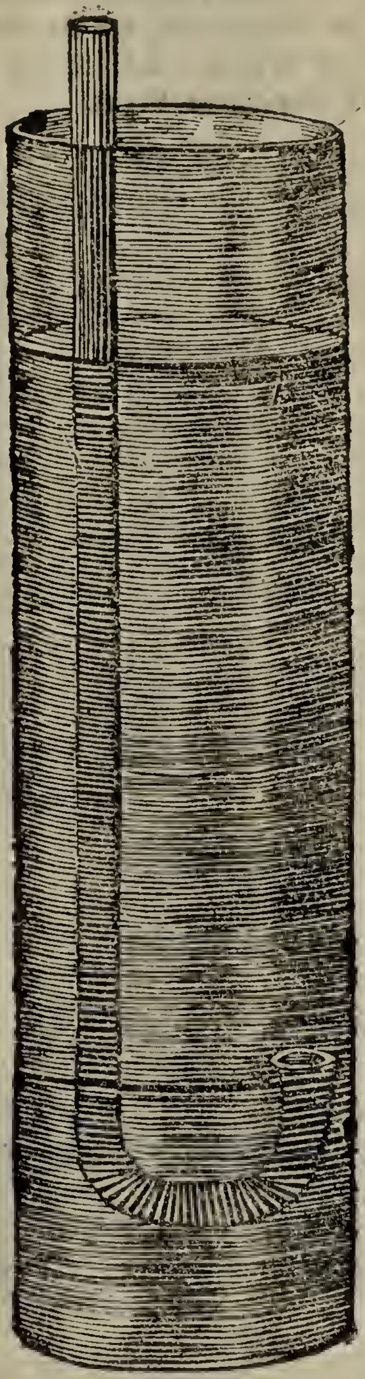
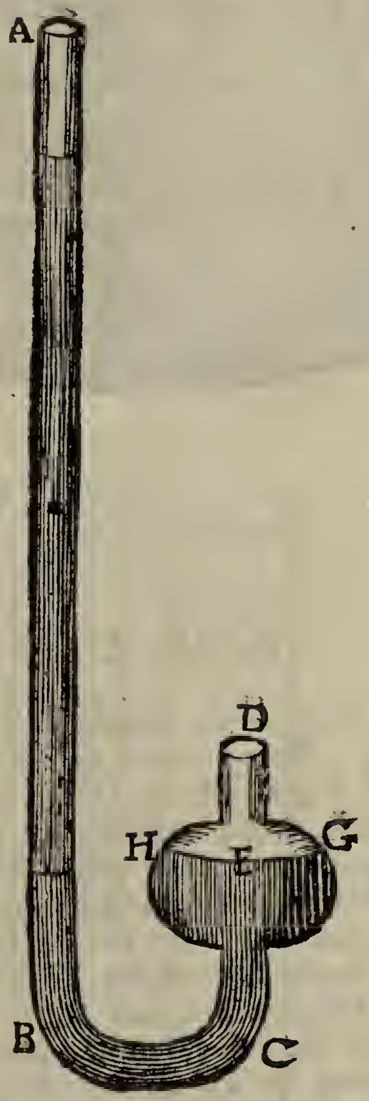


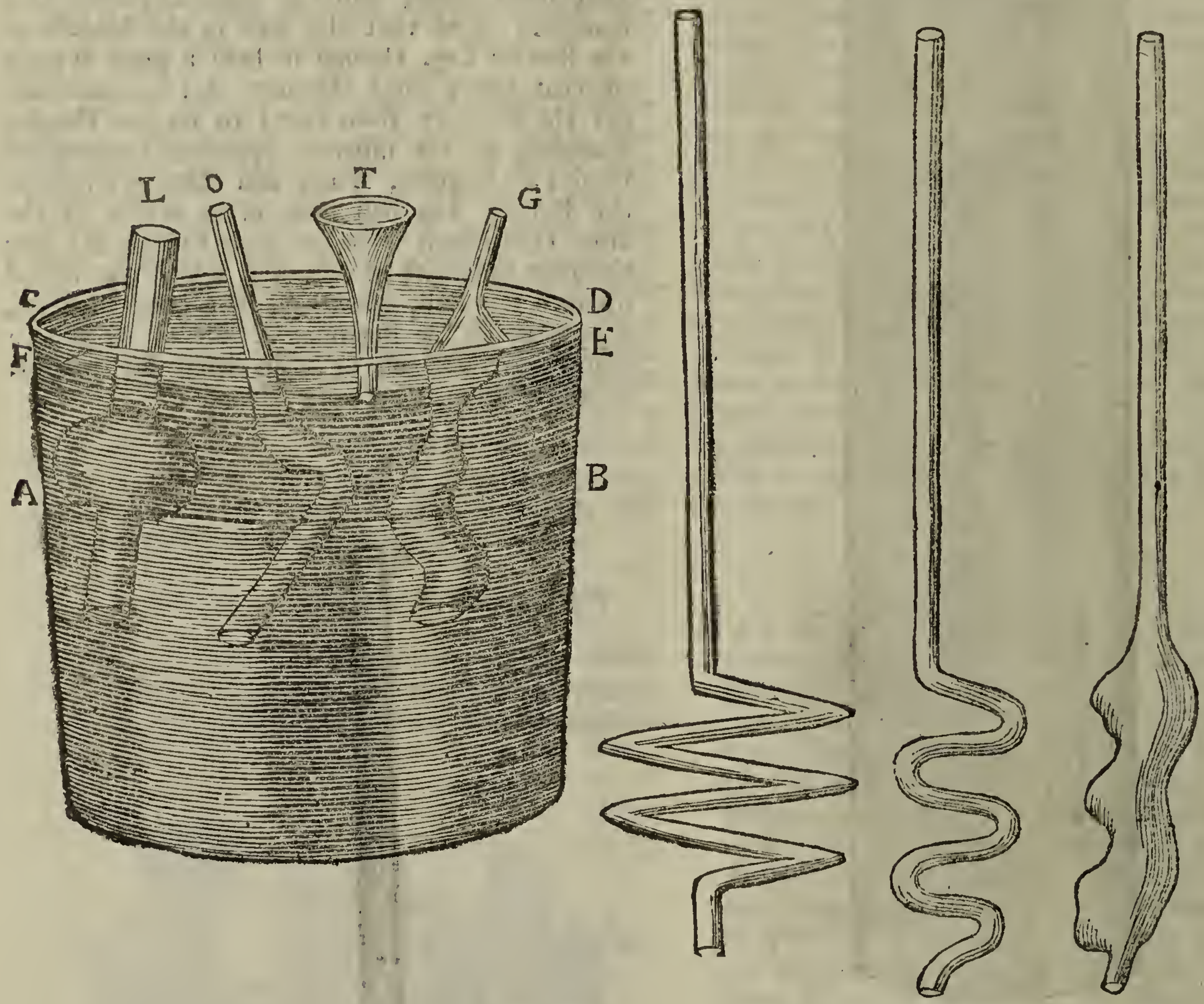
by raiſing up the Pipe, you ſhorten that Cylinder, the Oil will run out: As when by ſinking it lower, and ſo lengthening the Cylinder of Water, the Oil will be forced up higher into the longer Leg of the Tube.

You will find alſo by Experiment, That this Paradox will hold, whatever be the Figure of the ſhorter Leg of the Tube, whether opening broad like a Tunnel by Degrees, or whether it have a Spherical, or otherwiſe figured Cavity of conſiderable Dimenſions in the Middle of it.

For our Noble Author found, by providing a Syphon of the Figure annexed, and pouring in Mercury till it reached up to the Bottom of the Globular Part of the ſhorter Leg, and to an equal Height in the longer Leg of the Syphon; he found, I ſay, that if he poured Water in at the Top of the longer Leg, it would drive up the Mercury into the Ball of the ſhorter Leg, and more than half fill its Cavity; (which it would have filled quite, had the other Leg been long enough.) And that this Ball in the Middle of the ſhorter Leg, though it held a great Weight of that heavy fluid Mercury, did no more hinder the Mercury from riſing to its due Height, according to the different Specifick Gravity of thoſe two Liquors, Water and Mercury, than if the ſhorter Leg had been every where of the ſame Dimenſions with its upper Orifice *D*: For the great Quantity of Mercury which was forced up into the Ball, was there, in a good Meaſure, ſupported by the Bottom and Sides of it, and no more gravitated on *C*, than what lay perpendicularly over it between *B* and *C*.



And farther, to make out the latter Part of this Paradox, he took three Glaſs Pipes, *L*, *O*, *G*, of ſuch irregular Shapes as the Figure adjoining ſheweth; and theſe, by Holes purpoſely made for them in a Covert of Cork, he placed obliquely within a Glaſs Veſſel filled with Water up to *A B*. Then by the help of the Tunnel *T*, he gently poured in Oil of Turpentine, till its upper Surface reached to *F E*; which Oil he found did, by its Preſſure on the Surface of the Water, raiſe it up to an equal Height in all the three Pipes.



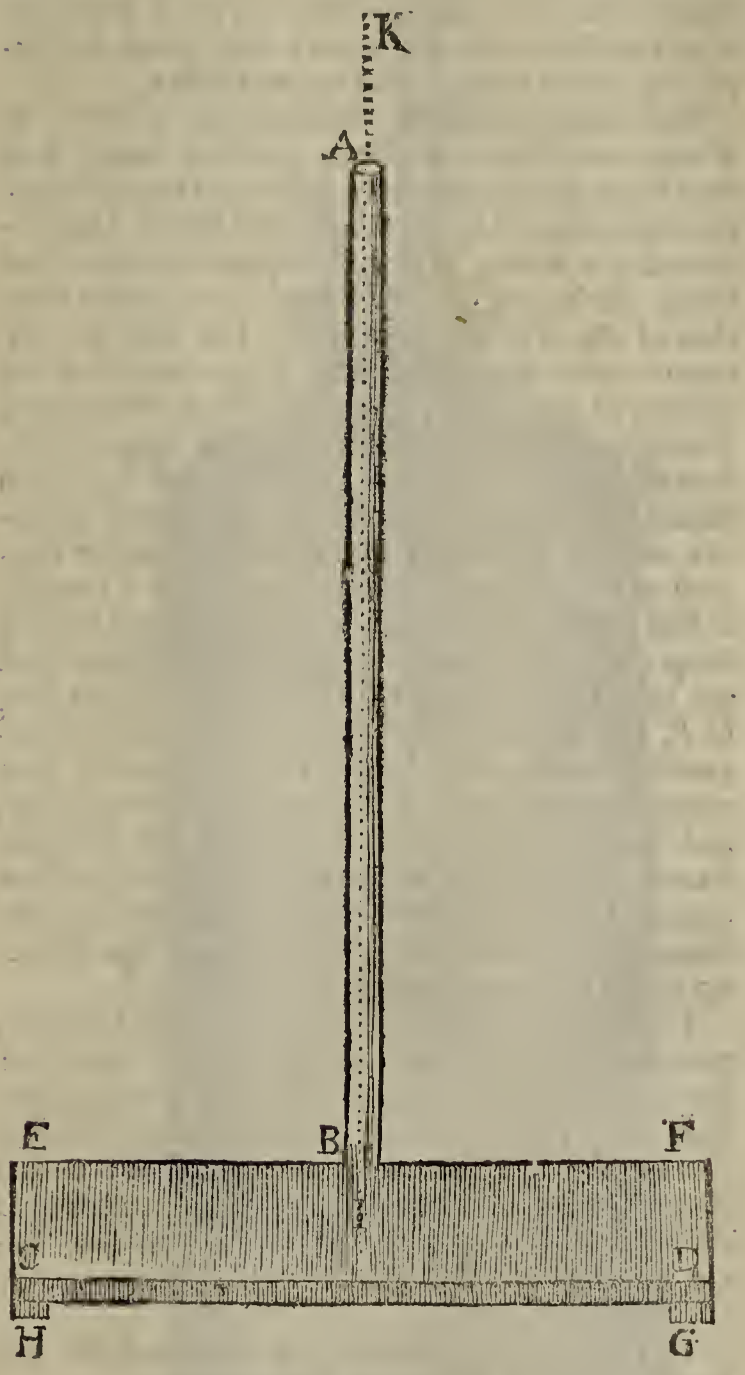
SCHOLIUM.

If a Cylindrical, or otherwiſe Figured Veſſel, have, by a Hole made in its Cover or Lid, a Pipe of any Length faſtened there, and the Veſſel by that Pipe be filled with Water, as alſo the Pipe it ſelf; the Baſis of that Veſſel doth ſuſtain a Preſſure equal to that of a Column of Water, whoſe Baſe is the ſame with the Bottom of the Veſſel, and its Height that of the Veſſel, Pipe and all.

This Paradox *Stevinus* adds by way of Appendix to the laſt; but the ways he propoſes to Experiment its Truth, are not ſuch as will anſwer Trial; and therefore Mr. *Boyle* deviſed the following Experiment, which (though not ſo accurate as ſome other) doth yet very well deſerve to be conſidered.

He ordered a Tin or Laton Veſſel to be made of the adjoining Shape, which had a looſe Bottom, *CD*, made of a flat Piece of Wood, covered with a ſoft Piece of Bladder, and greaſed on the lower Side near the Edges, that ſo leaning on the Rim of Wood *G H*, contiguous every where to the Inſide of the Laton, it might eaſily be lifted off from it, and yet lie ſo cloſe upon it at other times, that the Water ſhould not get between them. To the Middle of the looſe Bottom was faſtened a long String, that came up through the Body of the Pipe *A B*.

The Inſtrument thus fitted, there was Water poured in at *A*, which preſſed againſt the falſe Bottom *C D*, and kept it ſo tight down, that no Water ran out. When the Veſſel and Pipe were both filled with Water, the upper End of the String *K I* was faſtened to the Beam of a good Pair of Scales, and then as much Weight was put into the oppoſite Scale, as did lift up the falſe Bottom, *C D*, from the Rim *G H*, and ſo let out the Water; and this Weight he found to be very conſiderably more than what would have ſerved to lift up as much Water as that Veſſel did contain, had it been in an open one of the common Shape: But he neither tells us the Meaſure of the Veſſel, the Height of the Tube, nor the Weight which was required to raiſe the Bottom; which if he had done, 'twere very eaſy to have calculated the Quantity and Weight of a Column of Water, which ſhould have had the Bottom for its Baſe, and the united Length of Tube and Veſſel for its Altitude.



This Paradox, in the *Memoirs Mathematique & de Phyſique*, *A. D.* 1692. *P.* 12. is thus ſtated by Mr. *Varignon.*

If there be two Tubes or Veſſels, having the ſame Heights and Baſes, both filled with Water, but one of them made ſo tapering upwards, that it ſhall contain but 20 Ounces of Water, whereas the other holds 200; the Bottoms of theſe two Tubes ſhall ſuſtain an equal Preſſure of Water, *viz.* each of them that of the Weight of 200 Ounces, the Quantity of the Liquid contained in the greater Tube.

This is undoubted Fact, and agreed upon by all to be true, as long as the contained Liquor continues Fluid; but if it ſhould freeze, then it will by no means hold, the leſſer Quantity of Ice (to be ſure) being much lighter than the greater.

This Reaſon therefore of this ſurprizing Phænomenon ſeems to depend much on the Nature of Fluidity; and accordingly Mr. *Varignon* eſpouſes the Opinion of thoſe who aſſert, That the 20 Ounces of Water in the tapering, or otherwiſe unequally form'd Tube, as long as the Water continues liquid, do preſs and effectively charge *the Bottom* of the Veſſel, as much as 200 Ounces would do in a uniform cylindrical Tube of the ſame Baſe and Altitude.

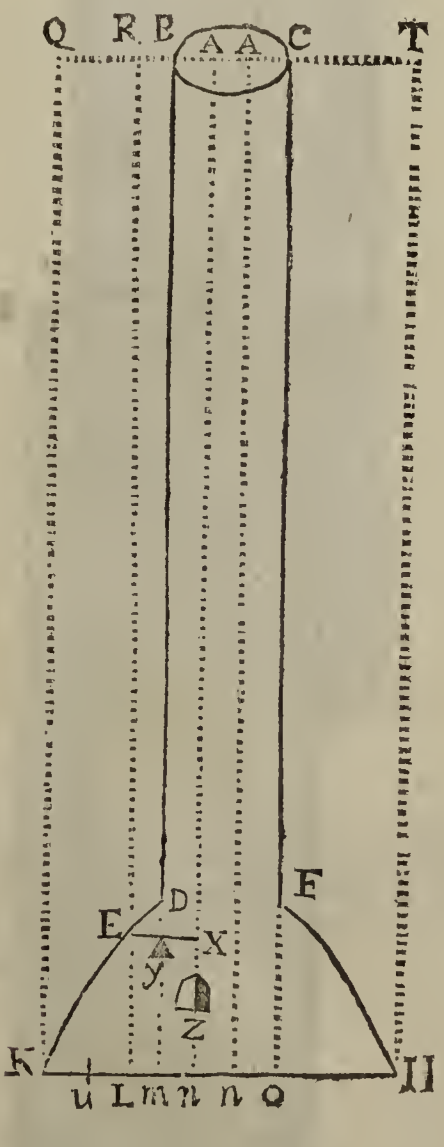
Others ſay the ſtraitned Sides of the unequal Tube, by hindering the riſing of the Water, do help to ſuſtain the Weight; and that the *Bottom alone* is not charged with the whole Preſſure, but a good Part of it taken off by the Sides.

Mr. *Varignon* thinks the Matter eaſily ſolvable in the former way thus:

The Tube *BACFHKEDB* (*See the following Figure*) having its bottom Part *DKHF* much larger than its upper Shank *BCFD*; I ſay, hath its Bottom *KH* charged with as great a Weight or Preſſure of Water, as if it were a cylindrical Veſſel, as *QTHK*, of the ſame Baſe and Altitude with the unequally ſhaped Tube.

Draw the Lines, as you ſee in the Figure, ſo ſhall *QV* repreſent a Column of Water in the ſuppoſed truly cylindrical Veſſel, having the Diameter of its Baſe double to that of *RL*, *BM*, or *AO*.

Then will the Column of Water *BN*, bearing upon the Arm *MN* of the *Libra LN*, whoſe *Hypomochlion* is imagined to be at *M*, be a Counterbalance to the Column of Water *EM*, which is kept down from aſcending any higher by the Side of the Veſſel *EL*, juſt as the Weight at *Z*, at the End *X*, of the *Libra EX*, whoſe *Hypomochlion* is at *Y*, is balanced by the Side of the Veſſel *ED*, which hinders the Arm *EY* from aſcending. Now *EY* being = *YX*, the Weight ſuſtained by the *Hypomochlion* at *Y*, is double to that at *Z*; wherefore the ſubjacent Point *M*, or that Part of the Bottom of the Veſſel *LN*, muſt be charged with double the weight of the Column of Water *BN*; or which is all one, will be preſſed with the weight of the Column of Water *RN*, which may be ſuppoſed to reach quite up to the Top.



Let us then take *ANLKED*, as equivalent to ſuch a Column; then will that Water be a Balance on the *Hypomochlion L*, to the Water leaning on the other Arm of the *Libra KL*, and kept down by the Side of the Veſſel *KE*; and conſequently, the part of the Bottom *KN*, will ſuſtain a Preſſure equal to that of the Column of Water *QN*; for this, by the abovementioned way of arguing, is the ſame as that of the Water contain'd in the Space *ANKDB*.

And thus, on the other Side, it may be proved, That the remaining Part of the Bottom *NH*, is preſſed upon by the Water *ANHFC*, equivalent to the weight of the Column of Water *TN*, reaching up to the Top.

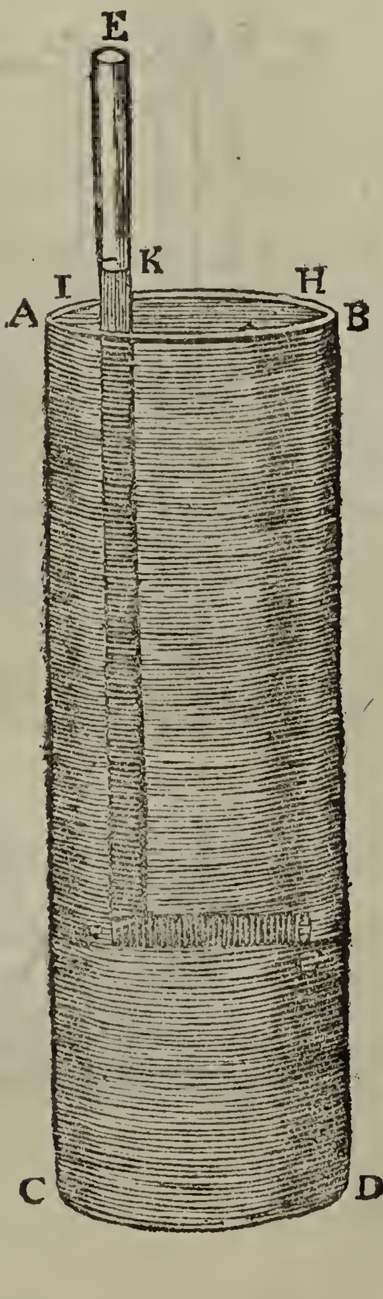
From whence it follows plainly, That the Water in the Tube *BDKHFC*, preſſes or gravitates on the Bottom equally with the weight of the cylindrical Column *QTHK*, having an equal Baſe with it.

All which Method of Arguing, will be clear enough to one that conſiders 'tis the Property of all Fluids, from the known Laws of *Hydroſtaticks*, to have their infinitely ſmall Columns, of which they conſiſt, to be every where a Balance to one another.

PARADOX VII.

That a Body immerſed in a Fluid, ſuſtains a lateral Preſſure from the Fluid; which alſo increaſeth as the Body is placed deeper beneath the Surface of the Fluid.

Take a ſlender Glaſs Tube, and let it be bent ſo near the Bottom, that the lower Part *FG* may very nearly make a Right Angle with the other Part *EF*. Dip this Pipe or Syphon in Oil of Turpentine, and take up about 3 or 4 Inches of it in the Pipe, which you may keep there by applying your Finger to the upper Orifice.



This done, move the Syphon into a Glaſs of Water, and place it ſo there, that the longer Leg may ſtand perpendicularly to its Surface, and that the other lower Leg may be ſo far below the Surface of the Water, as that the upper Surface of the Oil in the longer Leg, be but a little higher than that of the Water in the Glaſs: For then if you remove your Finger from the Top, the Oil in the Tube will very little, if at all, change its Station; which ſhews plainly, that there is a lateral Preſſure againſt the Oil at the lower Orifice *G*, which hinders its running out, tho' preſſed by the Cylinder of Oil contained in the perpendicular Leg. And as if you raiſe the Pipe up higher (keeping it ſtill in its perpendicular Poſture) the Oil will drop out; ſo if you ſink it lower, the Water will get in at *G*, and force the Oil all out of that Leg *GF*, and raiſe the Oil proportionably in the perpendicular one *EF*: Nay, if you thruſt it low enough, the Water will riſe up into the longer Leg, and bear the Oil above it; which laſt Circumſtance proves, That Water hath a lateral Preſſure againſt itſelf, as great as the perpendicular one from above, ſince that only can force the Water up into the perpendicular Leg.

If alſo keeping the Tube at the ſame Depth, you turn the Horizontal Leg here and there, or place its Orifice *G* in any Part of the imaginary Plane *FG*, the Oil will keep its former Station in the Tube, and neither riſe nor ſink; which ſhews, That this lateral Preſſure is equable and uniform in all Places or Parts of a Veſſel of Water, at the ſame Diſtance from its Surface.

Our Noble Author confirms the Truth of this Paradox by the following Experiment:

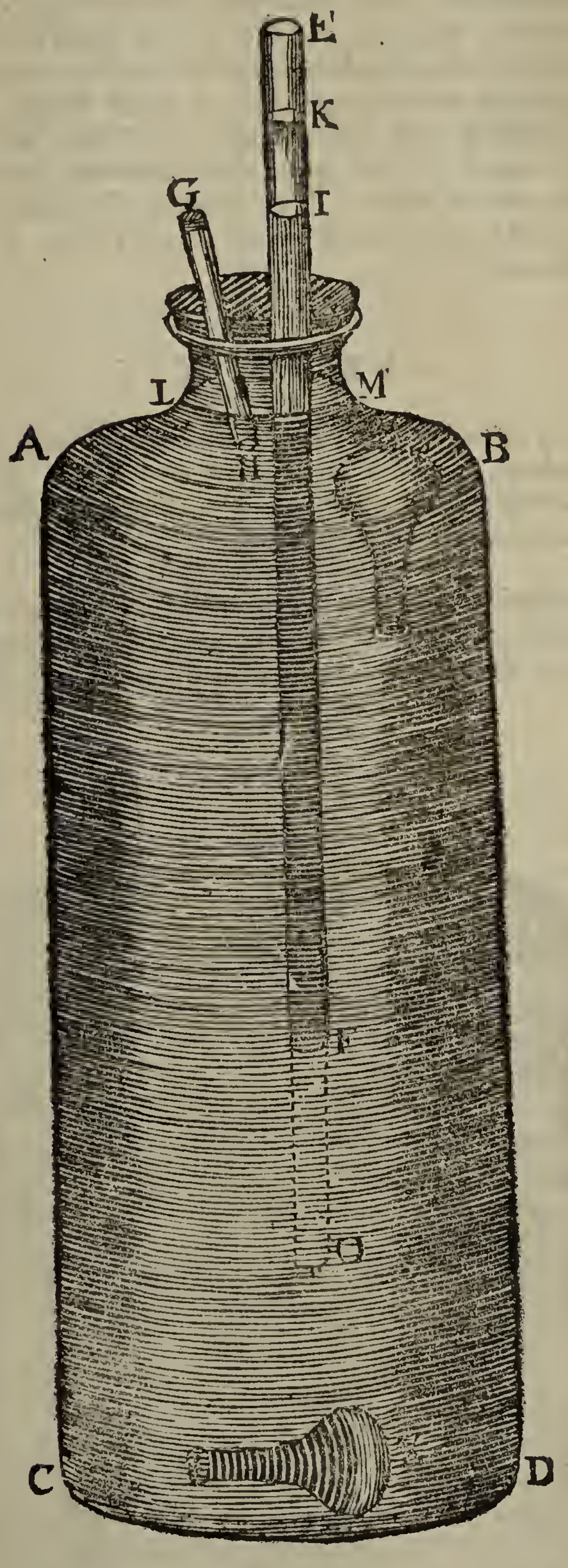
A ſmall Glaſs Bubble *X*, of the Figure in the Scheme annexed, with a very ſlender Neck, and ſo well poiſed, as that it could juſt float in the Water, and no more, being provided, was put into a wide-mouth'd Glaſs Veſſel, near filled with Water, and there left to float at the Surface of that Liquor. Then a Cover or Stopple of Cork was well fitted to the Mouth of the Glaſs, and was thruſt hard into it; after which there was an Hole burnt (with a hot Iron) thro' the middle of the Cork, into which was put a long ſlender Glaſs Pipe, reaching a good way into the Glaſs, and ſtanding perpendicularly to the Surface of the Cork.

Alſo in another Part of the Stopple was another ſmall Hole burnt, and into that was fitted another ſmall Glaſs Tube, which lay ſloping, but yet reached a pretty way down below the Cork.

The upper Orifice of this ſloping Tube was well ſtopt with Cement: With the ſame Matter alſo were all the Junctures between the Cork and the Glaſs, and between the Tubes and the Cork, carefully ſtopt.

This all done, the Veſſel was inclined ſeveral ways, that the Bubble *X* might get as far as it could from the Pipe; and then more Water being poured in at the upper Orifice of the open Pipe *EF*, till it reached to a good Height, as

ſuppoſe



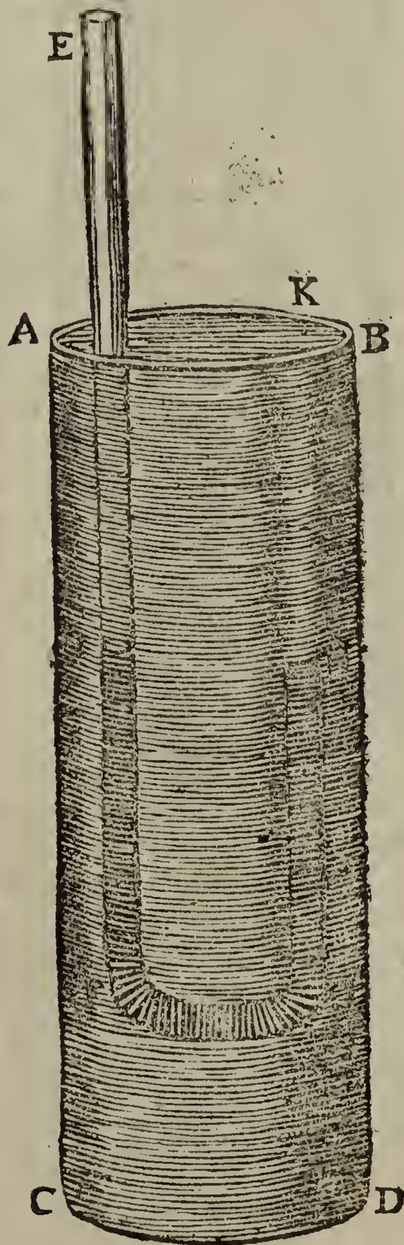
ſuppoſe to K in the ſaid Tube, the Bubble X would preſently ſink to the Bottom of the Veſſel, and there continue as long as the Water was continued at the ſame Height in the Tube $E F$ (the Reaſon of which you have already in *Experiment* 2. *Paradox* 2.) Now this proves, That the Preſſure of the Water contained in the Tube $E F$, doth not only affect the Parts of the Water immediately ſubjacent to it, but alſo thoſe that are remote from it; nay, and above it, ſince it could force the Water into the Bubble X, and ſo make it ſink, tho' it lay not near the Orifice F of the open Tube.

PARADOX VIII.

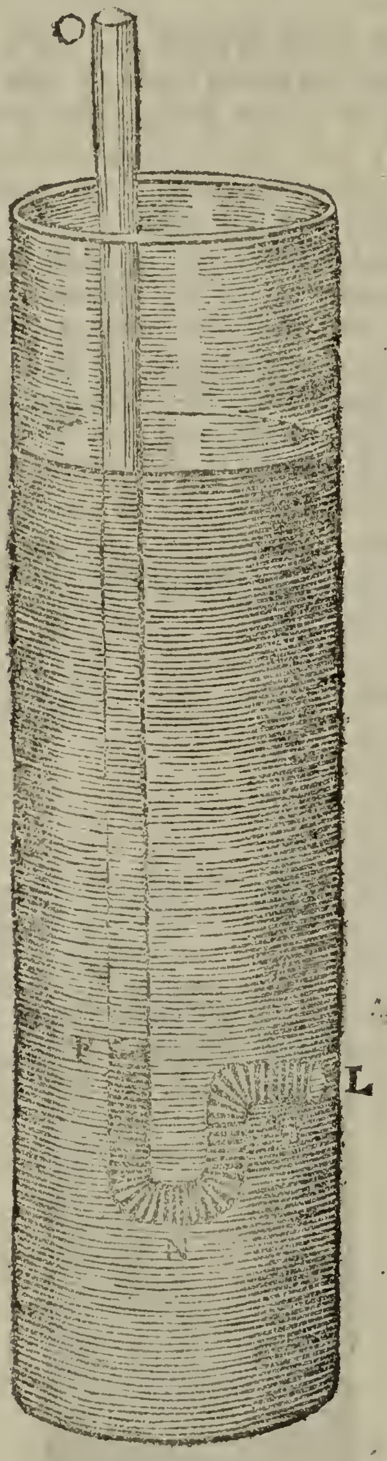
That Water may be made to depreſs a Body lighter than it ſelf, as well as to buoy it up.

A ſlender Glaſs Syphon $EFGH$, whoſe ſhorter Leg GH was about three or four Inches long, and turn'd up as near as could be parallel to the longer $E F$, was dipt in Oil of Turpentine, till the Oil filled the ſhorter Leg, and roſe to an equal Height in the longer.

Then the Orifice E being ſtopt with the Finger, the Pipe was moved into a Glaſs Veſſel of fair Water, and ſunk down there till the Surface of that Liquor was about half an Inch above the Surface of the Oil in the Syphon: And then the Finger being removed from the Top, the Oil in the ſhorter Leg was immediately driven downwards about an Inch; and as the Tube was ſunk lower, much more, till at laſt the Oil was driven out of that Leg quite, and the Water following it ſupported the Oil in the longer Leg, raiſing it alſo in the ſame Proportion. The Reaſon of which is obvious from what hath been ſaid in the former Paradoxes.



Our Author found alſo, that when he uſed a Syphon of the Figure annexed, the Water would firſt preſs the Oil Horizontally from *L* to *M*, then downwards from *M* to *N*, and at laſt (by ſinking the Tube ſtill lower) upwards from *N* to *P*: From whence it appears, that Water preſſes againſt any Body placed in it all manner of ways, and that proportionably to the Depth of the Body in it.



PARADOX IX.

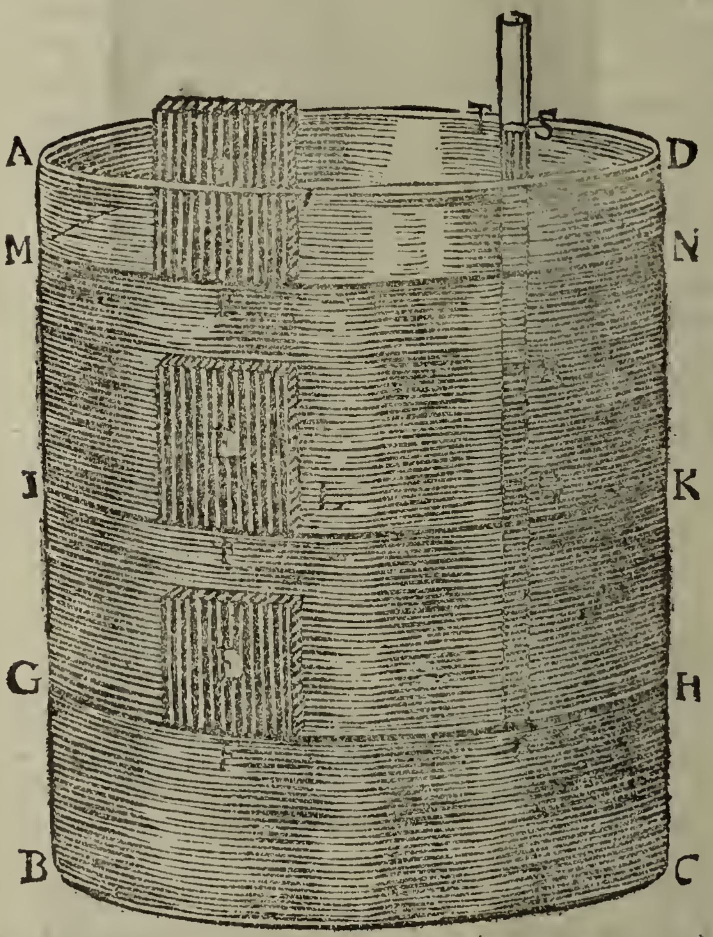
That whatever hath been ſaid of Poſitive Levity, a Parcel of Oil, lighter than Water, may be kept in that Liquor without aſcending in it.

This may very eaſily be experimented, by taking only a ſmall Glaſs Tube, and immerſing it an Inch or two under Water: Stop the upper Orifice with the Pulp of your Finger, and then a Column of Water of an Inch or two in length will remain ſuſpended in the Tube: Keep it ſo, and next dip the ſame Tube into a Veſſel of Oil of Turpentine, and removing your Finger, as much Oil of Tupentine as you pleaſe will riſe into the Tube; which, by putting on your Finger to the upper Orifice, may be there eaſily ſuſpended, as the Water was before. Keep it ſo, and then immerſe the Tube in a Glaſs of Water three or four Inches beneath its Surface, and you will find on the removal of your Finger, that the Water will riſe up into the Tube, and keep the Parcel of Oil ſuſpended between two little Columns of Water. The Reaſon of which is ſufficiently accountable from many Things already delivered.

PARADOX X.

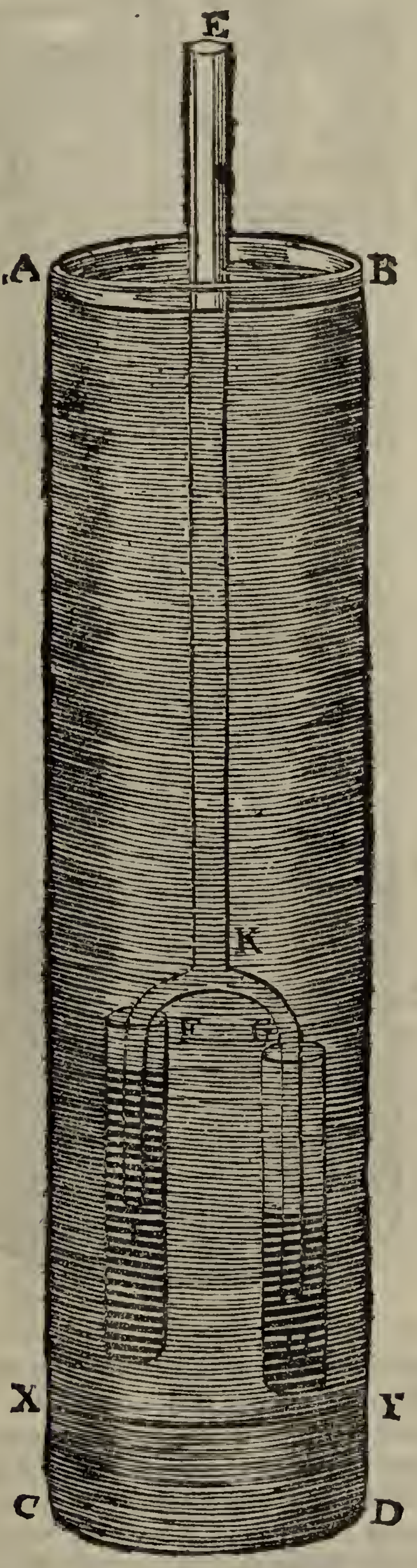
That the Cauſe of the Aſcenſion of Water in Syphons, and its flowing through them, may be explicated without having recourſe to Nature's Abhorrence of a Vacuum.

Provide a pretty large cylindrical Glaſs Tube Veſſel of about 18 Inches, or two Foot long, as *ABCD*; provide alſo a Syphon of two Legs, *KF* and *KG*, with a hollow Pipe, as *KE*, opening into, or communicating with them; to each of theſe two Legs of the Syphon (one of which muſt be longer than the other) tie with a String a Tube of Glaſs *I* and *H*, ſealed at the Bottom. Pour then in Water at *E*, and let it run out at *I* and *H*, till it hath filled the Tubes hanging at the Ends of the Legs of the Syphon ſo far, that the End of each Leg be a little beneath the Surface of the Water.



This done, and the Pipe and Syphon faſtened in its true erect Poſition, if you will fill the Veſſel *ABCD* with Oil of Turpentine, till it reach higher than the Syphon *K*, ſtopping in the mean time, if you pleaſe, the upper Orifice of the Pipe *EK* with your Finger.

After this you will find the Oil to preſs ſo on the Water in the Tubes *I* and *H*, as to force it up into the Legs of the Syphon as high as *K*; and that on the removing of your Finger from the Top *E*, the Water will begin to run out of the upper Tube *I* into the lower one *H*, as in or thro' a common Syphon or Crane.



Now 'tis plain, in this ingeniouſly contrived Experimment, that the Water runs through the Legs of the Syphon, tho' the Air coming down by *E K*, hath a free Communication with them both, ſo that here no *fuga Vacui* can be pretended as the Cauſe of the Waters running; but that 'tis plainly occaſioned by the Preſſure of the (lighter Fluid) Oil of Turpentine, on the Surface of the Water in the Tube *I*, till it force it up into the empty Leg of the inſerted Syphon as high as *K*, and then it deſcends down into the lower Veſſel or Tube *H*, thro' the other longer Leg of the Syphon. Indeed the Oil will gravitate on the Surface of the Water in both the Tubes *I* and *H*; and there being a longer Column of Oil over *H*, than there is over *I*, by about an Inch in length, the Preſſure will be greater on the Surface of the Water in *H*, by the great Weight of an Inch of Oil of Turpentine. But then it muſt be conſidered, that the Column of Water which deſcends in the Leg *G*, though reſiſted in its Motion by the Weight of an Inch of Oil, more than the Water which tends downwards in the Leg *F*, is yet alſo longer by an Inch than the other Column of Water in the ſhorter Leg *F*; and an Inch of Water of the ſame Dimenſions being heavier than an Inch of Oil, the Tendency or Motion of the Water muſt be from *F* towards *G*, not from *G* towards *F*; and conſequently the Syphon will work or run that way.

The Application of this Experiment to the Solution of the Motion of Water through Cranes or Syphons is very eaſy:

For when once a Syphon, by Suction or otherwiſe, is filled with the Liquor 'tis to tranſmit; if the Legs of it be not above 34 or 35 Foot in length, and one of them be longer than the other, the Liquor muſt continue to run thro' it as long as there is any to riſe in it, or that the Syphon hold ſtanch: For ſince the Preſſure or Weight of the incumbent Atmoſphere is capable of raiſing Water in Pipes (where it cannot come to preſs) to the Height of 34 or 35 Feet, as our Noble Virtuoſo proves in his *Phyſico-Mechanical Experiments*; and here being manifeſtly no Gravitation of the Air on the Water included in the Syphon, as long as the Syphon is right and ſtanch, the Water muſt continue to keep running, becauſe the Difference of the Preſſure of the Air on the lower Veſſel of Water, and on the upper, being nothing near ſo conſiderable as the Difference between the Weight of the Water in the longer Leg of the Syphon, and that in the ſhorter, the Tendency or Motion muſt be out of the ſhorter into the larger.

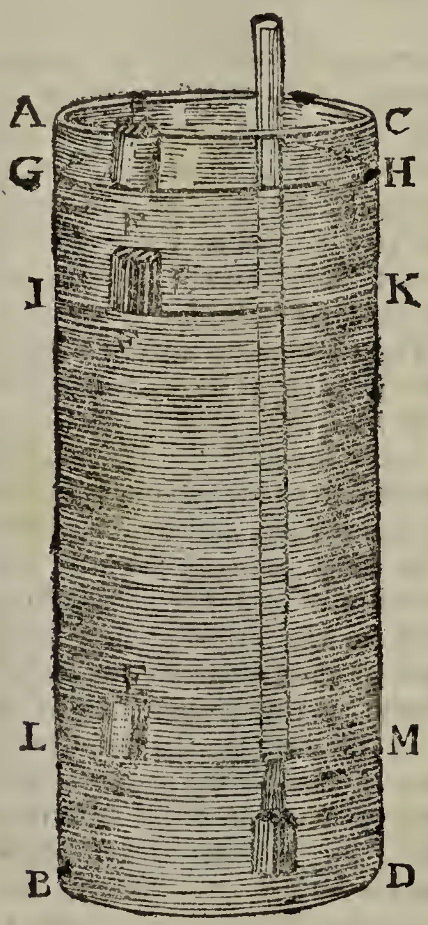
But then, if never ſo little an Hole be made in the Crane or Syphon, or any Leak be there, the Water can no longer run, becauſe the Air now comes to preſs on the Water within the Syphon, as well as on that without it, and conſequently muſt hinder its Courſe of running.

PARADOX XI.

That a Solid Body, as ponderous as any known, tho' on the Surface of the Water it will ſink by its own Weight; yet if it be placed in a greater Depth than that of 20 *Times its own Thickneſs, it will not ſink, if its Deſcent be not aſſiſted by the Weight of the incumbent Water.*

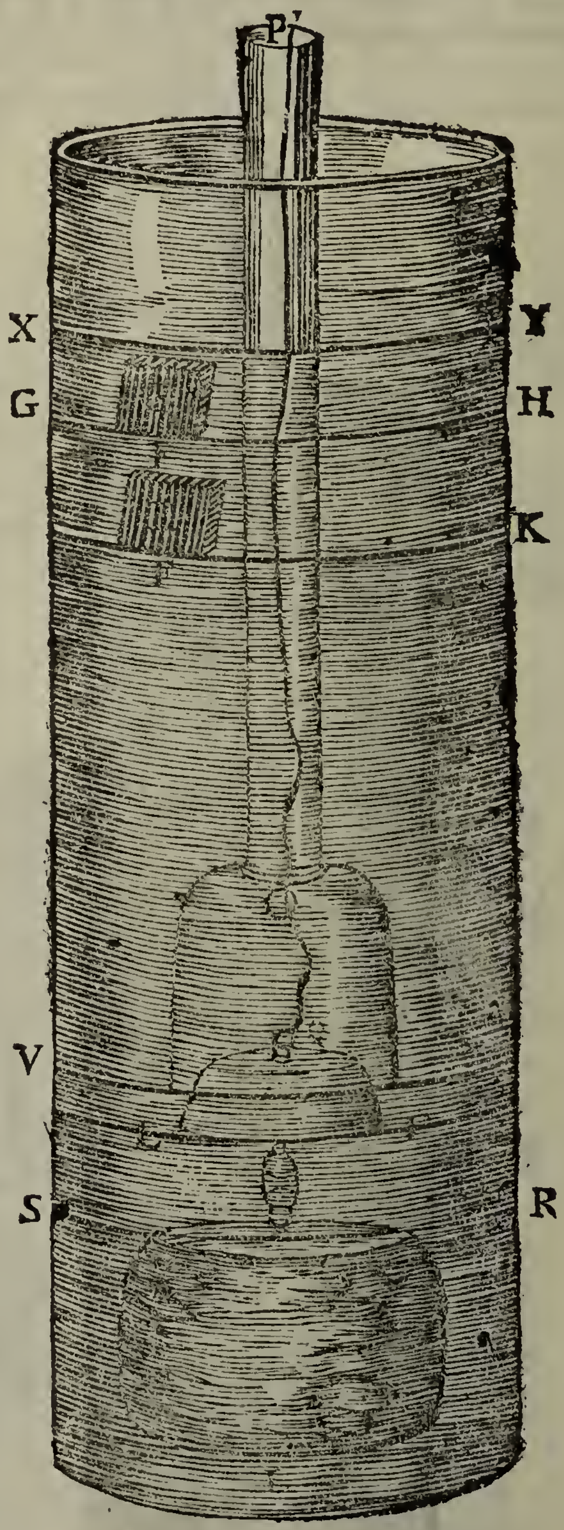
Fill a deep Glaſs Veſſel, of about two or three Feet in length, (a large Tube, ſealed at the End, will do very well) with Water, as in the Figure: If then a little Cylinder or Cube of ſolid Braſs, as *E*, be any where placed, either at the Surface, Middle, or towards the Bottom of the Veſſel, ſtill it muſt ſink to the Bottom, becauſe the compound Column of Water and Braſs together (which Braſs is almoſt nine times as heavy as common Water) will gravitate or preſs more than any Column of Water only of the ſame Length and Diameter; and conſequently the

Braſs will diſplace the Water under it, and ſink lower and lower till it come to the Bottom; and this is the Caſe of a Stone, or any other heavy Body, &c. But yet, if you ſuppoſe this Piece of Braſs placed on the imaginary Surface *L M*, above 9 times its depth under Water, and that it were poſſible to keep off the preſſure of the Water perpendicularly incumbent upon it, it is not reaſonable to ſuppoſe, That the Braſs ſhould ſink at all, but be ſupported and buoyed up there: For the Braſs can in this Caſe charge the Water under it at *F*, with no more than juſt its own proper and abſolute weight; whereas all the other Parts of the Surface *L M*, are charged or preſſed upon by Columns of Water, which, ſuppoſing them to be of the ſame Diameter with the Piece of Braſs, or ſingly heavier than the Braſs, becauſe they are above 9 times as long as the Braſs is thick; and therefore preſſing or gravitating more on *L M* than the Braſs doth, muſt keep the Braſs ſuſpended; which cannot ſink, becauſe it cannot remove a Weight of Water heavier than it ſelf. And from the ſame Principles 'tis plain from Reaſon, That if the Braſs be placed yet lower, and the Preſſure of the incumbent Water be, as before, taken off, inſtead of ſinking, it muſt needs riſe, and be forcibly lifted upward. This alſo muſt be the Caſe of a Piece of Gold, if it were placed in theſe Circumſtances, in a Veſſel of Water, where the perpendicularly incumbent Preſſure was kept off, and the Gold above 19 Times its own Thickneſs in the Liquor.



To make good which probable Reaſoning by Experiment, our Author proceeded thus:

A large deep Glaſs Veſſel was provided, of the Figure annexed, which was filled with Water near to the Top, as to *XY*: Then at the Bottom of a Glaſs Tube, open at both Ends, there was, by good Cement, faſtened a Braſs Valve, into which was turned and fitted a Piece of ſolid Braſs, *E F*, which, tho' it would ſtop the Valve exactly, would yet eaſily fall out, if not ſuſpended or ſupported by any thing: To the upper Side of this Braſs Piece *E F* let there be a Button faſtened, whereby it may, by means of a String coming up through the Pipe *PO*, be drawn up cloſe, ſo as to ſtop the Valve.



All things being thus fitted, if you ſink the Tube with its Valve and Braſs Stopple, and by the String keep the Stopple faſt in, till the Braſs be about nine times its Thickneſs beneath the Surface of the Water in the Glaſs Veſſel, you will find, tho' you looſen the String, that the Braſs Stopple will not fall out; becauſe the Valve being cloſe, and the Sides of the Glaſs Tube not capable of being permeated by the Water, there can no more of that Liquor preſs upon the Braſs Stopple perpendicularly; but whatever Preſſure it ſuſtains, is from the Tendency of the Water upwards, which muſt needs ſerve to ſupport it, ſince that is greater than the Weight of the Braſs. But if you raiſe the Tube up towards the Top of the Water, the Braſs Weight over-balancing there the

Preſſure of the Water upward, it will ſoon, if not held by the String, ſlip out of the Valve and fall down, and the Water will immediately riſe in the Tube.

And if, inſtead of raiſing the Tube up towards the Surface of the Water *XY*, you ſhould ſink it down much deeper toward the Bottom, you will find that this Braſs Stopple, which will fall out readily in the former Station, will now ſupport a conſiderable Weight (as *L*) faſtened to it by a Bottom made on the under Surface of it; but that on the raiſing of the Tube upward, this additional Weight will make the Stopple drop out much ſooner than before: As ſuppoſe, when the Tube is raiſed only to the height of three or four Inches, *&c.* which Experiments do abundantly confirm the Truth of this Paradox; and no doubt can be made, but that if a Gold Stopple had been uſed inſtead of a Braſs one, and the Tube let down into the Veſſel, till the Gold had been above 19 times its thickneſs under Water, even that ponderous Metal would have there remained without ſinking.

N. B. *This Experiment may moſt readily and eaſily be tried (as I have often done my ſelf) with Mercury: If you take a ſlender Glaſs Tube or Pipe, of about* $\frac{1}{8}$ *of an Inch Bore, or rather leſs, and dipping the lower End into a Veſſel of Mercury, you then ſtop the upper End with your Finger, by which means you may keep half an Inch, more or leſs, of that ponderous Fluid ſuſpended in the Pipe; and then if, keeping your Finger thus, you immerſe the Tube into a long Glaſs of Water, till the little Column of Mercury be more than* 13 *or* 14 *times its length under Water, you will find, on removing your Finger, that the Mercury will be kept ſuſpended in the Tube by the Preſſure of the Water upwards; but that if you raiſe the Tube up but a very little above the former Station, the Mercury will immediately run out: Whereas, if before you had removed your Finger from the Top, you had ſunk the Pipe ſo low, as that the Mercury were* 12 *or* 14 *Inches*, &c. *below the Surface of the Water, that then the Mercury would be violently forced up, and make ſeveral Aſcents and Deſcents in the Tube, till by degrees it had gained its proper Station in it, according to the Laws of Specifick Gravity.*

Indeed this Experiment will not be of a very long Continuance, becauſe the Water will by degrees get up between the Mercury and the Sides of the Tube; but it will laſt a few Minutes, and longer if the Tube be very ſlender, which is time enough to ſatisfy any one of the Truth of this Paradox.

☞ From hence may the Adheſion of the two poliſhed Marbles together, when the upper is ſuſpended, and a great Weight hung to the latter, be eaſily accounted for: For ſince the Atmoſphere preſſes or gravitates with its whole Weight on the under Surface and Sides of the lower Marble, but cannot do ſo at all on its upper Surface, which is cloſely contiguous to the upper and ſuſpended Marble, it muſt needs keep the Stone buoyed up or pendulous, 'till ſuch time as either the Air inſinuate it ſelf in between the Stones, or that a Weight be affixed to the lower Stone, which exceeds the Weight of a Pillar of Air, whoſe Diameter is that of the Marble, and its Height reaching to the Top of the Atmoſphere: And that this is the reaſon of their Coheſion, is plain, becauſe when they are thus ſuſpended, and do adhere to each other in the Receiver of the Air-Pump, on a very few Pumpings of the Air out of the Receiver, they will immediately disjoyn and fall aſunder.

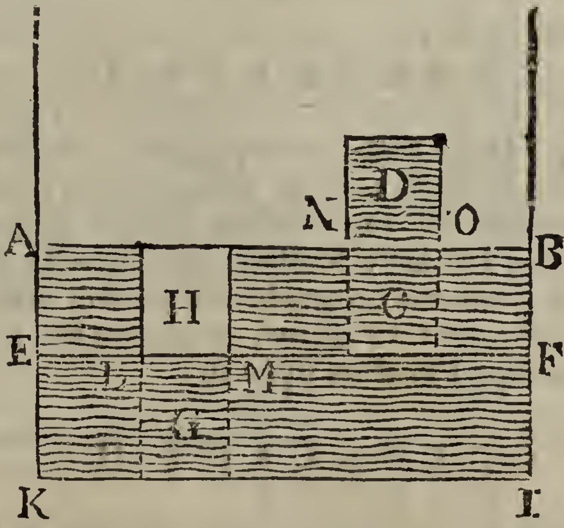
Thus far went this Excellent Gentleman: But that the Mathematical Reader may alſo be pleaſed in his way too, he has the following ſhort Account of *Hydroſtaticks*, drawn up from Dr. *Wallis* and ſome other Authors.

PROP. I.

Let the Veſſel A K I B be fill'd with Water, or any other Fluid, whoſe Surface we ſuppoſe to be even; (which, though in reality it will not be a Plane but part of the Surface of a Sphere concentrical with the Earth; yet we ſhall all along conſider it as a Plane, or as differing inſenſibly from one;) I ſay, if this Surface be ſuppoſed even at firſt, 'twill ſtill remain ſo.

Which is thus demonſtrated:

Let the even Surface *A B* of the Veſſel *AKIB* (See *Fig.* 1.) be either not preſſed at all, or elſe preſſed equally in every Part, as will be the Caſe, allowing the Preſſure of the Air, which is an Homogeneal Body with reſpect to Gravity, and preſſes equally in all the Parts of ſo ſmall a Surface. Now ſince the Parts of the Fluid below are all acted upon by Gravitation, they cannot aſcend, and ſo elevate any part of the Surface *A B*; nor can the Fluid ſubſide in one part, and ſo be elevated in another, being the Preſſure againſt the Bottom is every where equal, and conſequently hinders one another's Subſidence, ſuppoſing the Fluid divided into any number of equal Columns: Hence it follows, from the contrary Preſſure of theſe equal Columns at the Bottom of the Veſſel, that there can be no Motion; that is, the Surface will remain even without any manner of Diſturbance. *Q. E. D. See Dr.* Wallis's *Mecha. Prop.* 8. *Cap.* 2. *de deſcenſu gravium.*

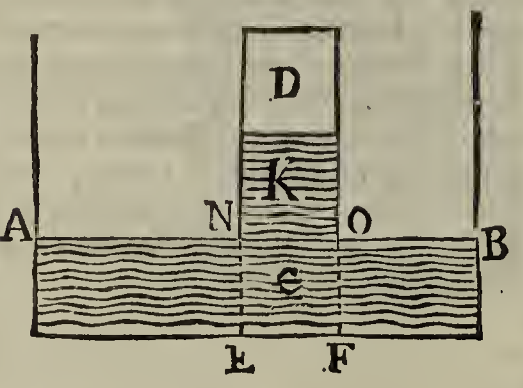


But if the Fluid be put out of this State by ſome external Force, ſo that one Part of it, as *D*, (*Fig.* 1.) be elevated above the reſt, do but remove the Force, and it will return to its former Horizontal Poſition, partly upon the Account of its Fluidity; the Parts above flowing down into thoſe Places that are below them, and alſo becauſe the ſubjected Part *C* being more preſt than the other Parts of the Surface *A B*, this Preſſure will be continued to the Bottom of the Veſſel; where, by reaſon of the Reſiſtance made by the Bottom, it will be communicated to thoſe Parts that are leſs preſt, forcing them to aſcend ſo long till the *Æquilibrium* be again reſtored, *i. e.* till *A B* become even and parallel to the Horizon: So that altho' the Surface be not a Plane, as it was ſuppoſed in the foregoing Propoſition, yet if the Force be removed that made its Surface unequal, it will again recover its former State.

There may be ſome Accidental Variations which we ſhall not at preſent conſider, as that the Parts of the Fluid may happen to be tenacious, *&c.*

If the Fluid be preſſed more in one part than another, as in *C*, by reaſon of the incumbent Body *D*, (*Fig.* 1.) (which Body is ſuppos'd to be ſpecifically heavier than Air) then will the part of the Fluid *C* ſubſide, forcing the other Parts of *A B* to riſe, in order to make way for it; and this will happen till ſuch time as *C* is no more preſſed than any other Parts of the Surface *A B*.

And what we have ſaid of *A B* is equally true of any parallel Surface with the Fluid; as of *E F*, whoſe Surface is Horizontal, and will remain ſo, the Preſſure being every where equal: But if the immerged Body *A* be ſpecifically heavier than the Fluid, the ſubjected Part *G*, as ſuſtaining a greater Weight, will be depreſt, forcing the Fluid to riſe in the Parts about *E L* and *M F*, which Parts have a leſs Preſſure upon them than the Part *L M*.

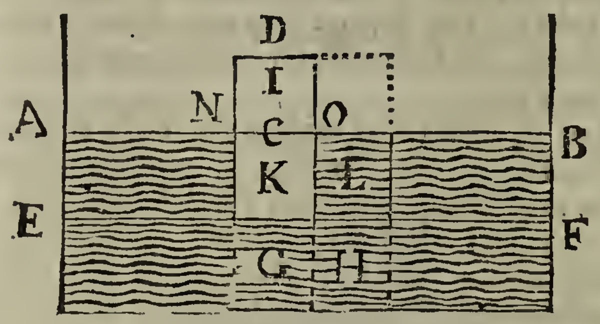


COROLLARY I.

Fig. 1. If the Body *D* be preciſely as heavy as ſo much Air equal to it in Bulk, then will *N O*, that Portion of the Surface which *D* inſiſts upon, have the ſame Preſſure upon it with *A N* and *O B*; and conſequently the Surface will retain its Horizontal Poſition, as having ſtill every where an equal Preſſure upon it.

COROLLARY II.

If the Body *D* (*Fig.* 2.) be ſpecifically lighter than Air, and if it be ſuppoſed not to fly away, then will that part of the Fluid it inſiſts upon, be leſs preſſed than *A N* and *O B*, and conſequently will riſe ſo high, till *K* and *D* together be equal in Weight to that Column of Air whoſe Room they poſſeſs; for then, and not till then, the Preſſure upon *A N O B* will be equal.



COROLLARY III.

If the Body *D* (*Fig.* 3.) be ſpecifically heavier than Air, but lighter than Water, it will then depreſs that Part of the Fluid that is under it, and ſubſide ſo far into the Water (ſuppoſe to *G*) until the Gravity of that Part of it which is above the Surface of the Water, *viz. I.* bears the ſame Proportion to as much Air as equals it in Bulk: As the Gravity of as much Water as is in Bulk equal to *K*, (*viz. I.*) bears to the Gravity of the immerſed Part *G*. To illuſtrate which, put G for the Gravity of *I*, *g* for the Gravity of an equal Portion of Air, *M* for the Gravity of *K*, and *m* for the Gravity of *L*; then, before the parallel Surface *E F* can have an equal Preſſure upon it, *G M* muſt be equal to *g m*. (*i. e.*) $G : g :: m : M$.

COROLLARY IV.

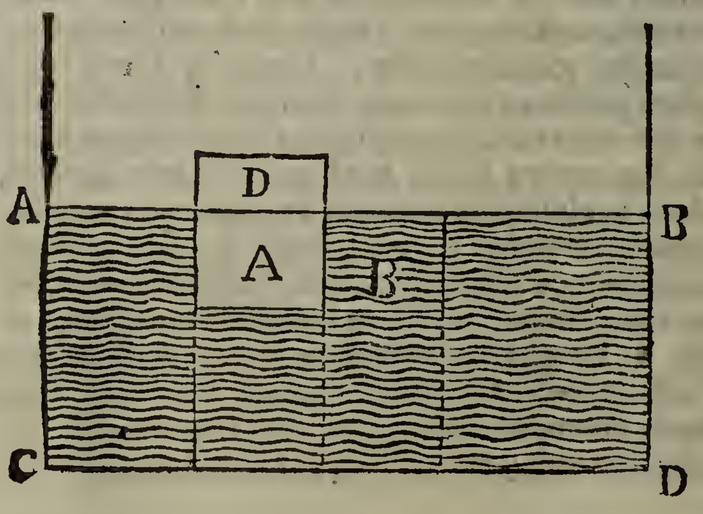
If *D* or *H* (*Fig.* 1.) be, Bulk for Bulk, heavier than Water, then will *C* and *G*, the Parts they inſiſt upon, have a greater Preſſure upon them than the other Parts of the two Surfaces *A B* and *E F*; and this will be every where true, ſo that *D* or *H* muſt ſink to the Bottom of the Veſſel *K L*.

COROLLARY V.

If *D* (*Fig.* 1.) be preciſely as heavy as Air, then (by *Cor.* 1.) it will inſiſt upon the Surface without ſubſiding at all; for it will be the ſame thing as if ſo much Air preſt in the room of it: But if it be ſpecifically as heavy as the Fluid it is immerged in, then where ever it be placed within the Fluid, there it will remain; for as to Gravitation, there will be no Difference between the Fluid and it.

PROP. II.

If A *be a Body ſpecifically lighter than* B, (Fig. 4.) *an equal Portion of the Fluid (in which it is immerged) then will it riſe with a Force proportionable to the Exceſs of Gravity of* B + *above* A.



Demonſtration.

For the Gaavity of A put x; for that of B, $x+y$ (y repreſenting the Exceſs of Gravity of B above A) then take a Body, as D, with the Gravity y, and let $D+A$ be immerged in the Veſſel $ABCD$, and it will ſubſide ſo far, till $x+y : x :: y :$ is to the Gravity of a Quantity of Air equal to D, (which becauſe 'tis very inconſiderable, may be neglected) or till B, a Quantity of Water equal in Bulk to the immerſed part A, ſhall be equal in Gravity to the whole $D+A$: But a Quantity of Water, equal in Bulk to A, ſhall (by the Suppoſition) have its Gravity equal to the Gravity of $D+A$; therefore A is the part immerſed.

From this *Æquilibrium* it is evident, That the Force with which A preſſes upwards, is equal to the Gravity of D downwards; but the Gravity of D is equal to the Exceſs of Gravity of B above A; therefore A aſcends with a Force proportionable to the Exceſs of Gravity of B above A, *Q. E. D.*

PROP. III.

If the Body A (Fig. 4.) *be ſuppoſed heavier than* B, *(an equal Portion of the Fluid in which it is immerged) it gravitates with the Exceſs only of its Gravity above that of* B.

Demonſtration.

Let the Gravity of B be $= x$, and that of $A = x+y$; then theſe two Forces being directly contrary, x and x deſtroy one another, ſo that A only gravitates with y, the Gravity by which A exceeds B. *Q. E. D.*

COROLLARY.

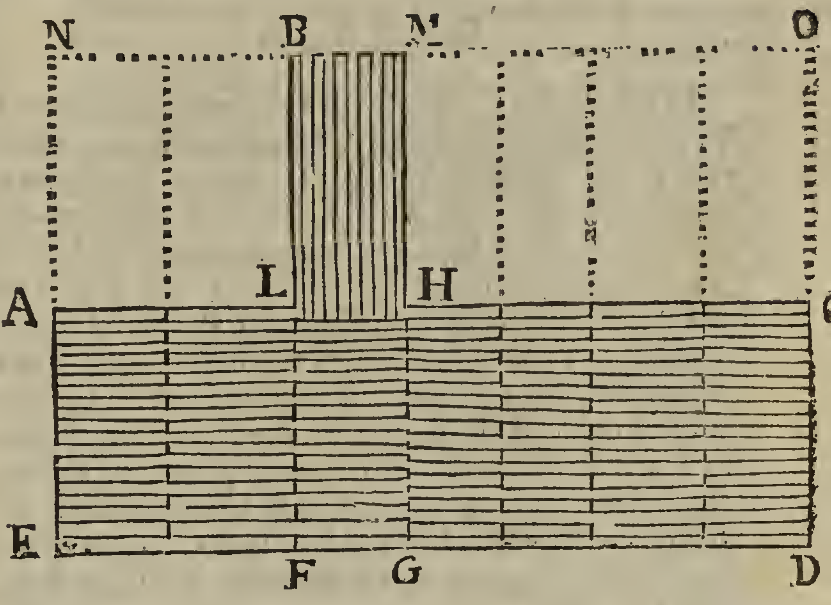
Hence it is manifeſt, That of Bodies immerſed in Water, or any other Fluid, we only perceive the Difference between the Weights of the immerſed Body, and of ſuch a Quantity of Water, or any other Fluid, in which the Body is immerſed, which is equal to the Bulk of that Body.

PROP IV.

All Fluids preſs upon ſubjected Bodies according to their perpendicular Altitude, and not according to their Latitude.

Which is thus demonſtrated.

Let there be a Veſſel $ALBMHCDE$ full of Water, (*Fig.* 5.) then becauſe the Column BF is heavier (becauſe longer) than HG, 'tis certain, that if the Veſſel was open at H, GH would aſcend till ſuch time as the Colums BF and GH were in an *Æquilibrium*; or of an equal Height; but ſeeing the Veſſel at H is ſhut, and conſequently hinders GH from aſcending, the Preſſure upwards upon H is equal to the Difference of the two Columns BF and HG, *i. e.* BL. And ſince all Preſſure is reciprocal, *i. e.* as much as H is preſſed upwards by the Liquor, ſo much it preſſes the Liquor downwards againſt the Bottom, (Action and Re-action being always equal one to another:) If to this Preſſure be added the Gravity of GH, the Preſſure upon the Bottom G, will be the ſame as if it had the entire Column BF inſiſting upon it.



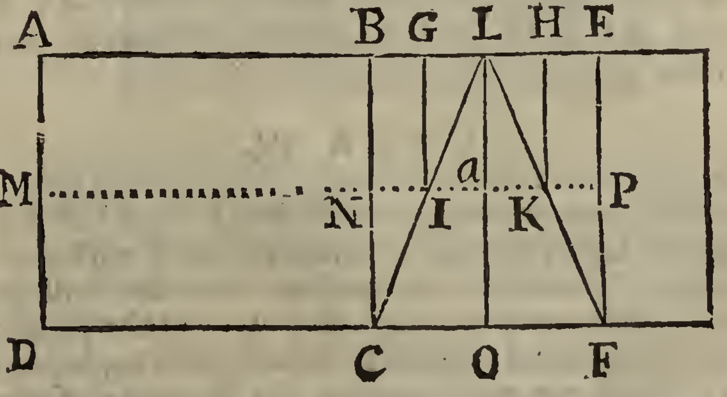
The ſame may be demonſtrated of all the reſt of the equal imaginary Columns; and conſequently 'tis evident, That the Bottom of the Veſſel ED ſuſtains as great a Preſſure, as if $NEOD$ were full of Water. *Q. E. D.*

SCHOLIUM, by Mr. *Ditton.*

The Momenta of Fluids preſſing upon any Fund, may be look'd upon as Products; the Quantity of Matter being one of the Factors that compoſe theſe Momenta: The other, the *preſſing Velocity*, *gravitating Conatus*, or whatever elſe you pleaſe to call it; only remember, that in the following Conſiderations I ſhall make uſe of the Word *preſſive Velocity*, as being the fitteſt I can at preſent think of.

CASE I.

In Veſſels having equal Altitudes, tho' different Forms, the Momenta will be equal from *Prop.* 4. therefore their Quantity of Matter, and preſſive Velocities, will be reciprocally proportional: So in the Cylindrick Veſſel $BCFE$ (*Fig.* 6.) and the Conical one LGE, the Moments being equal, the Quantity of Matter in the former: will be to the Quantity of Matter in the latter reciprocally :: as the preſſive Velocity of the whole Fluid in the latter: is to that in the former. But the Ratio of their Quantities of Matter is known from Geometry; therefore the Ratio of their preſſive Velocities will be known too.



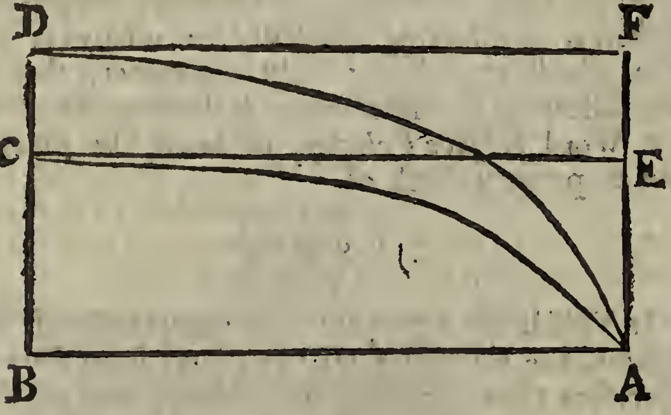
CASE II.

In the Veſſel *L C F*, (as in the foregoing Figure) 'twill be an eaſy thing to find the Momenta of the Fluid preſſing upon the ſeveral imaginary prrallel Funds, as *C F*, *I K*, &c. for the Momentum of *L C F* : Is to the Momentum of *L I K* : : As the Momentum of the Cylinder *B C F E* : to the Momentum of the Cylinder *G I K H*. But univerſally, the Momenta of Cylinders are as their Altitudes, by the laſt : Therefore let *L C F* be what Figure it will, the Preſſure upon a Fund, as *I K* : Is to the Preſſure upon a Fund, as *C F* in the Veſſel continued ſo far : : as the Abſciſſa *L a* : is to the Abſciſſa *L O* ; that is, as *I a* to *C O* : And if you ſuppoſe it a parabolick Veſſel, as *I a q*, to *C O q*, &c.

N. B. *We here conſider the Fund* I K, *as making a diſtinct Veſſel, and not meerly an imaginary one ; ſo that* L I K *and* L C F *may be conſidered as two diſtinct Veſſels.*

From what is ſaid may be found the Proportion of the preſſive Velocities in the Veſſels *LCF*, *LIK* ; for we know the Ratio of their Momenta, and the Ratio of their Magnitudes ; therefore that alſo of their preſſive Velocities, the other Factor of their Momenta, will be known too.

But the Momenta of Veſſels of different Heights, having the ſame common Fund, will be as thoſe Altitudes.



Suppoſe *A D* and *A C* two parabolick Veſſels, having the ſame common Abſciſſa *A B* ; then will their Momenta upon the common Fund *A B*, be as their Ordinates *B C* and *B D*, *i. e.* as the Area's of the two Semi-parabola's *A D B* and *A C B*, or in a Sub-duplicate Ratio of their Parameters, as is evident from Conicks.

Likewiſe in Hyperbolical and Elliptical Veſſels, having the ſame tranſverſe Diameter and Abſciſſa common to both, the Preſſure upon the common Abſciſſa, as a Fund, will be as the Area's *A C B* and *A C D* of the Semi-Ellipſis and Semi-Hyperbola.

CASE III.

But now we come to conſider the Veſſels *L I K* and *L C F*, (*Fig.* 6.) as communicating with each other : And here the preſſive Velocities will be very different from what they were in the former Suppoſition : In order to expreſs the Proportions of which, we muſt conſider the Momenta of the ſeveral Portions of the Fluid taken from the Vertex, and imagin'd to be cut off by Plains parallel to the Baſe : And firſt, the Momentum of the Portion *L I K*, upon the Fund *C F*, is equal Momentum of *A M B N*, on the Fund *D C* ; therefore the Momentum *L C F* : Is to the Momentum of *L I K* : : As the Momentum of the Cylinder *A B D C* : To the Momentum of the Cylinder *A M B N* ; *i. e.* as *L O*, *L a*. But having the Momenta's and Quantities of Matter, we can eaſily find the other Factors ; that is, the preſſive Velocities of *L C F* and *L I K*, upon the Fund *C F* ; which may be expreſſed thus :

The Ratio of the Momenta's is equal to $\frac{LO}{La}$,

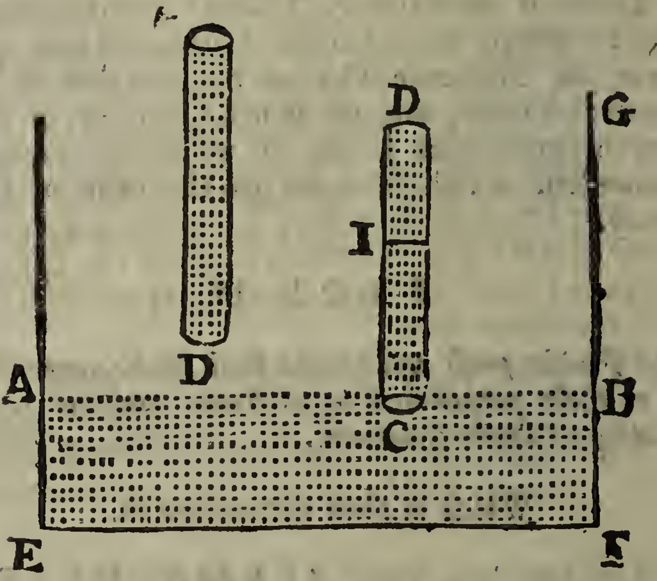
and the Ratio of the Magnitudes is equal to $\frac{LCF}{LIK}$;

therefore the Ratio of the preſſive Velocities will be $\frac{LO \times LIK}{La \times LCF}$.

CASE IV.

To compare together the preſſive Velocities in both theſe diſtinct Caſes, (*viz.* 2, 3.) 'twill be only neceſſary to conſider, That in the Firſt Caſe, where we imagined a different Fund, as *I K*, the Momentum of the Portion *L I K*, is equal to that of the Cylinder *G H I K* ; and in the latter Caſe, where we ſuppoſe all one and the ſame Veſſel, and ſo the Fluid *L I K* preſſing on the Fund *C F*, that then the Momentum of that Portion *L I K*, will be equally the Momentum of the Cylinder *A M B N* ; therefore the two Momenta's being as the Cylinders *A M B N* ; and *G I K H*, (which have equal Altitudes) will be as *M N* to *I K*, *i. e.* as *N P* : *I K*.

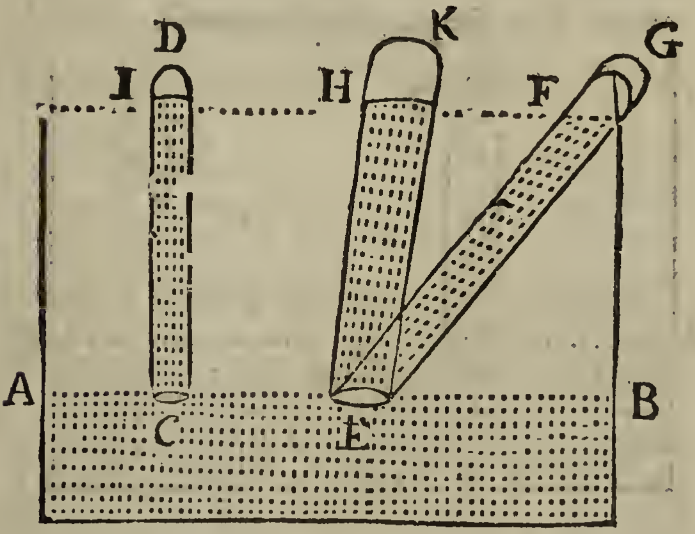
But having the Ratio of the Momenta's, we have alſo that of the preſſive Velocities of one and the ſame Quantity of the Fluid *L I K*, when conceived as preſſing upon the Fund *I K* in one Caſe, and on the Fund *C F* in the other.



CASE V.

Let *B E*, (*Fig.* 8.) be a Veſſel fill'd with Mercury to the Altitude *A E* ; then, as in the way of making the *Torricellian* Experiments, take a pretty long Glaſs Tube, ſhut at the End *D*, but open at *C*, which fill with Mercury ; and ſtopping the open End *C*, invert the Tube, and put the ſaid End *C* into the Mercury *B E* : 'Tis evident from the firſt and general Propoſition, That if the Mercury contained in the Tube, preſs more upon *C*, than the Air upon the other Parts of the Mercury which are expoſed to it; 'tis evident, I ſay, That the Mercury in the Tube will deſcend ſo far, (ſuppoſe to *I*) till the Preſſure be equal on all the Parts of the Surface of the ſtagnant Mercury in the Veſſel: But if the Mercury in the Tube preſs leſs upon *C*, than the external Air does on the Mercury without, then the Mercury within the Tube will aſcend ſo high, till the Preſſure of the Mercury within the Tube be equal to that of a Column of Air of the ſame Diameter in any Part of the Veſſel without.

This is clear from *Prop.* I. and needs no other Demonſtration.



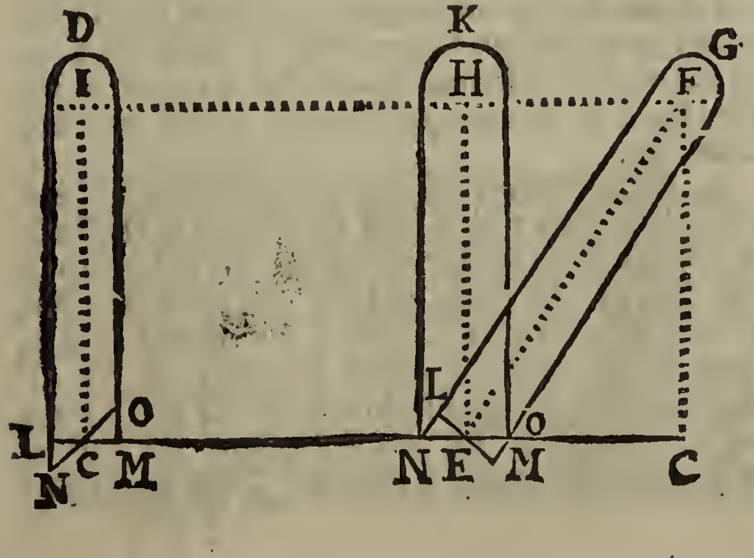
But here it may be enquired, Why, if the erect Tube *C I* (*Fig.* 9.) be put in an oblique Poſition, as in *G E*, the Quickſilver ſhould notwithſtanding be found at the ſame perpendicular Height as before; ſince *G E* being longer than *CI*, 'tis certain there muſt be more Mercury contained in that than in this.

To this I Anſwer:

The Figure of the Surface of the Mercury in the Baſe *E* of the Tube *E G*, will become Elliptical, and conſequently enlarged by this oblique Poſition; for tho' it will be of the ſame Breadth ſtill, yet it will be ſo much longer, as is the Ratio of the Diameter *E*, to the Diameter *C*: *i. e.* as the tranſverſe Axis of that Ellipſis to its Conjugate.

But I ſhall demonſtrate, That the Diameter of the Baſe *C*: Is to the Tranſverſe of the Baſe *E*:: As the Length of the Tube *C I*: Is to the Length of the Tube *E F*.

For ſuppoſe *L C M* the Baſe of the erect Cylinder *CD*, which will be a Circle; and *N C O* the Baſe of it cut obliquely, which will be an Ellipſis.



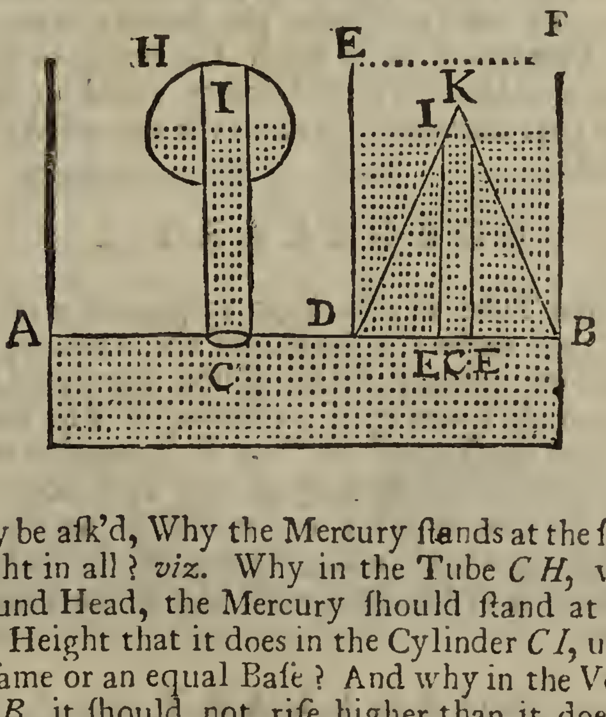
Then let the Cylinder *C D* be reclined into the Poſition *E G*, ſo that *N C O* may become *N E O*; *i. e.* in an Horizontal Poſition; the Cylinder *E F* will be equal to an erect Cylinder upon the ſame Elliptical Baſe *N E O*, and between the ſame Parallels *H F*, *N O*: From *F* therefore let fall *F C* perpendicular to *N E O* produced, and by this means we ſhall have the Triangles *F E C* and *E N L* ſimilar; for the Angles at *C* and *L* are right, and the Angle *F E C* = *L N E*, ſeeing each of them, together with *L E N*, makes a Right-Angle: Therefore *F E* : *F C* (is *CI*) :: *N E* : *E L* :: 2 *N E* : 2 *E L*; Or as the Baſe *E*: Is to the Baſe *C*. *Q. E. D.*

And now the Reaſon plainly appears, why more Mercury is kept ſuſpended in *E G* than in *C I*; (*Fig.* 9.) For the Baſe *E* of the oblique Tube *EG*: Is as much greater than the Baſe *C* of the erect Tube *C D* :: As is the Length of the Former: Than the Length of the Latter.

But then it may be farther enquired, Why, in the two equal Cylinders *E F* and *E H*, (*Fig.* 10.) the Mercury ſhould not riſe higher in the Former than in the Latter, ſince Dr. *Wallis* has demonſtrated, *Cap.* 2. *Prop.* 19. That equal Bodies gravitate in Proportion to their Declivities; and conſequently the Gravity of the Fluid within the Tube *E F*, being weaken'd by the obliquity of the Tube, 'tis but reaſonable to ſuppoſe, That the Mercury ſhould be raiſed to a greater Height than in the erect Tube *E H*, whoſe Poſition does not at all weaken or hinder the Gravitation of the Fluid.

But here it ought to be conſider'd, That tho' the Gravity of the Fluid in the Tube *E F* be leſſened in proportion to the obliquity of the Tube, yet at the ſame time the Preſſure upwards is weaken'd or hinder'd in the ſame Proportion, the Angles *E F C* and *F E H* being equal; ſo that here is a ſort of Compenſation made, and the ſame Force which keeps the Mercury ſuſpended in *E H*, will be no more than ſufficient to buoy up that in *E F* of an equal Altitude with the Former.

Alſo, Since Tubes and Veſſels, having the ſame or equal Baſes and Altitudes with Cylinders and Priſms, may, notwithſtanding, contain more or leſs Mercury than thoſe Cylinders and Priſms (as is apparent from *Fig.* 11.) it may very reaſonably be aſk'd, Why the Mercury ſtands at the ſame Height in all? *viz.* Why in the Tube *C H*, with a round Head, the Mercury ſhould ſtand at the ſame Height that it does in the Cylinder *C I*, upon the ſame or an equal Baſe? And why in the Veſſel *D K B*, it ſhould not riſe higher than it does in *E D B F*?



The Reaſon of theſe two Phænomena I take to be this:

Firſt, In the Tube *C H*, the Mercury contain'd in the Head, without the inſcribed Tube *C I*, is not ſupported by the Baſe *C*, but by the Sides of the Head of the Tube; and conſequently the Preſſure upon *C*, is the ſame in both Tubes *C H*, *C I*; therefore the Altitude of the Mercury in both of them muſt be the ſame.

Secondly, Although the Veſſel *D K B* be much leſs than the Circumſcribing one, yet it will be an eaſy Matter to account for the Mercury's riſing no higher in that than in this; for at thoſe Parts of the Baſe, as *C*, where the Mercury has a free Aſcent, it ariſes to a certain determinate Height, as *C I*, in the Veſſel *D K B*; but the Aſcent of the other Parts *D E* and *E B*, is impeded by the Sides of the Veſſel *D K* and *K B*, as much as if *E D I* preſt upon it; therefore it cannot riſe any higher than the Mercury in the circumſcribing Veſſel *E D B F*.

PROP. V.

If the Mercury in the Tube C D (See Fig. 9.) *be kept ſuſpended at the Altitude* C I, *yet if the Aggregate of the Tube and Mercury be left to it ſelf to deſcend freely, it will ſink into the ſtagnant Mercury ſo far, till the Gravity* D I *or* D C (*the Part above the Surface* A B) *bears the ſame Proportion to the Gravity of as much Air equal to it in Bulk* :: *As the Weight of a Quantity of Mercury equal in Bulk to that Part immerſed, bears to the Weight of the immerſed Part of the Tube, together with the Mercury included in* C I.

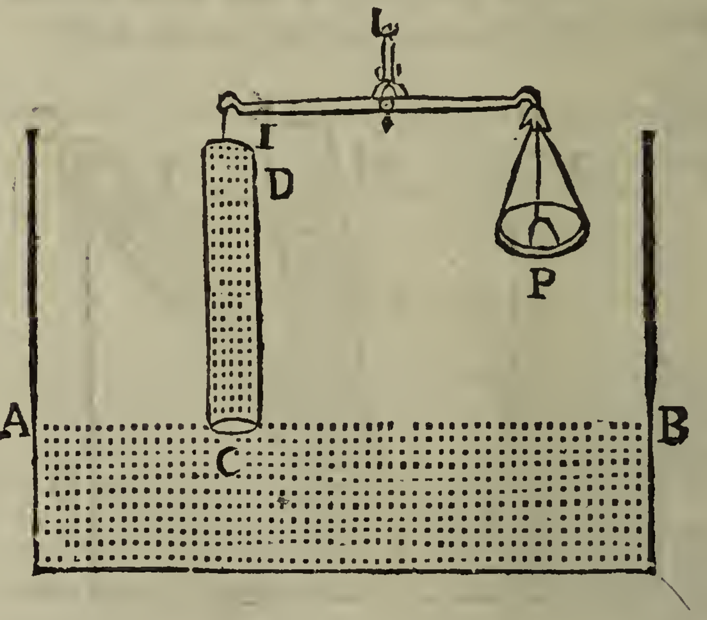
For the Air upon the outſide *D*, of the Top of the Tube *D C*, is very nearly equal to the Preſſure of the Air upon the other Parts of the Surface of the Mercury *A B*; but this Preſſure upon the Top of the Tube being added to the Preſſure of the included Mercury, together with the Weight of the Tube, will make the Preſſure upon *C* more than double to the Preſſure upon any other Part, being the Effect of a double Column of Air of the Diameter of the Tube: And the Weight of the Tube and incumbent Air being not ſuſtained otherways, (by *Cor.* 3. *Prop.* 1.) the Tube will ſubſide ſo far, till the Part above the Surface bears the ſame Proportion to as much Air equal to it in Bulk, as a Quantity of Mercury equal in Bulk to the Part immerſed, bears to the immerſed Part. *Q. E. D.*

COROLLARY I.

If the Tube *D I* be kept ſuſpended with its End *C* juſt under the Surface of the Mercury, the weight or tendency of the Tube downwards, is equal to the Gravity of a Column of Air, inſiſting upon the Top of the Tube *D I*, together with the Exceſs of the Gravity of the Tube above an equal Portion of Air; or, which is nearly the ſame thing, equal to the Weight of the incloſed Mercury *D C*, together with the forementioned Exceſs.

COROLLARY II.

But if *D C*, the Altitude of the inverted Tube, be leſs than *C I*, (where the Mercury, as in a common Barometer, would ſtand, were it (not hinder'd) and conſequently if the Air preſs more upon the other Parts, than the Mercury *D C* does upon *C*; then will ſo much of the Weight of the Tube and Mercury be abated, or ſo much Weight may be ſuppoſed to be taken out of the Scale *P*, (*Fig.* 12.) as is equal to the Exceſs of the Preſſure upon the other Parts above that upon *C*; for the Force upwards in *C* can ſuſtain ſo much Mercury, as is contain'd in a Tube whoſe Altitude is *C I*: Therefore if the Altitude *C D* be leſs than *C I*, 'tis plain the Preſſure upwards at *C* will be able to buoy up as much more Weight than *D C*, as *D C* wants of *C I*; that is, ſo much Weight may be taken out of the Scale *P*, to bring it to an *Æquilibrium*.



For the Preſſure of the incumbent Air upon the Parts of the Surface *A B* ſurrounding *C*, is ſufficient to ſuſtain either a Column of Air of an equal Weight with the former, or a mixt Column made up of 'em both, which does not exceed the Gravity of one of them, but cannot ſuſtain them both together, or any thing more than what is equal to the Gravity of one.

Suppoſe the Part *C* of the Surface of the Mercury *A B* (*Fig.* 12.) expoſed to the open Air, then there will be ſuſtained a Column of the incumbent Air, equal to what is ſuſtained by every other equal Part of the Surface; but neither Mercury, nor any thing elſe more intenſively or ſpecifically heavier than Air, for that would deſtroy the *Æquilibrium*, by *Prop.* I.

2. If, as in the *Torricellian* Experiment, which ſuppoſe made, the Preſſure of the incumbent Air be kept from acting upon *C* by *I*, the Top of the Tube *C I*, or any how elſe; the Preſſure at *C* upwards will then ſuſtain a Column of Mercury equal in Gravity to a Column of Air upon the ſame Baſe, but it can ſuſtain nothing elſe; ſo that the Tube, with the incumbent Column of Air upon the Top of it, muſt be ſuſtained ſome other way, either by the Hand, or by an equal Weight in the oppoſite Scale, *&c.*

3. If the Preſſure of the incumbent Air be kept off only in Part; that is, if the *Pondus* in the Scale *P*, be leſs than the Gravity of the Air reſting upon the Top of the Tube, and the Tube it ſelf; then *C* will ſuſtain a mixt Column, *i. e.* partly of Air, part of Mercury: And the Quantity of Air ſuſtained by *C*, is equal to the Exceſs of the Weight of the incumbent Air and Tube above the *Pondus* *P*; and the Mercury within the Tube wants juſt

ſo much of the Weight of the Mercury in the laſt Caſe, as that Exceſs amounts to.

4. If the *Pondus* in the Scale *P*, be greater than the Weight of an incumbent Column upon the Top of the Tube, together with the Tube it ſelf, then it will elevate the Tube out of the Mercury.

This Matter will ſtill be more clear by the following Inſtances.

Suppoſe *C*, (*Fig.* 12.) that Part of the Surface *A B* upon which the Tube inſiſts, to be ſo large, as that being expoſed to the open Air, it can ſuſtain a Column of Air of 10 Ounces: Then if the *Torricellian* Experiment be made, and *C* be defended from the Gravitation of the Air upon it, then will, in its room, be ſuſpended a Column of Mercury, or any other Fluid which does not exceed 10 Ounces.

Let us imagine the Weight of the Tube to be two Ounces; then will the Weight of the Tube, together with the incumbent Air, be equal to 12 Ounces nearly, (I ſay nearly, for any one will perceive, from *Prop.* 5. that it wont be exactly ſo;) from which Preſſure *C* muſt be entirely freed, which may be done by the Hand, or by 12 Ounces in the Scale *P*.

Now let us ſuppoſe 4 Ounces taken out of the Scale *P*, then there will remain only 8, which cannot be a Balance for 12: Therefore the Tube *D C* will ſink down into the ſtagnant Mercury, (the Preſſure downwards upon *C* being greater by 4 Ounces, than the Preſſure any where elſe on the Surface of the ſtagnant Mercury) till the incuded Mercury weigh only 6 Ounces.

But here it may ſeem ſtrange, Why 8 Ounces in the Scale *P*, can buoy up the Tube equal to 2 Ounces, added to the Weight of the incumbent Air equal to 10 Ounces: But the Reaſon of this is evident; for the Preſſure upwards in *C*, is 4 Ounces greater than any where elſe; or, which is the ſame Thing, 4 of thoſe 12 Ounces (the Weight of the Tube and incumbent Air) will not be perceived, by reaſon of the contrary Tendency of the Mercury upwards at *C*; ſo that there will remain only 8 Ounces, equal to the Weight of the *Pondus* in *P*.

But if, inſtead of 4 Ounces, the whole *Pondus* had been taken out of the Scale *P*, *C* would then have a greater Preſſure upon it than it is able to bear, and conſequently will give way, and ſuffer the Tube and Mercury to ſink quite down to the Bottom of the Veſſel.

If, inſtead of 4 Ounces, 2 only had been taken out of the Scale *P*, there will remain 10 Ounces, which will take off 10 of the 12 Ounces, (the Weight of the Tube and Air together) and the remaining 2 Ounces will preſs upon *C*, which, with 8 Ounces of Mercury, will make 10; ſo that the Mercury in the Tube, in this Caſe, will weigh 8 Ounces, as before it weighed only 6; *i. e.* the Tube will aſcend till the Mercury within it weigh 2 Ounces more than it did before.

If 2 Ounces more be added to *P*, the Tube will riſe until the Mercury in it weigh 2 Ounces more than before, *i. e.* 10; but if any more Weight be added to *P*, the Tube will be elevated out of the Mercury.

From the foregoing Principles 'twill be no difficult Matter to account for that Experiment of Water riſing higher in very narrow Tubes, than the Surface of the Water in which they are immers'd; for if you take a very ſlender Tube, open at both Ends, and put one End in a Veſſel of Water, the Water within the Tube will be found ſomething above the Level of the Water without, more and more proportionably to the Smallneſs of the Tube in which the Experiment is made.

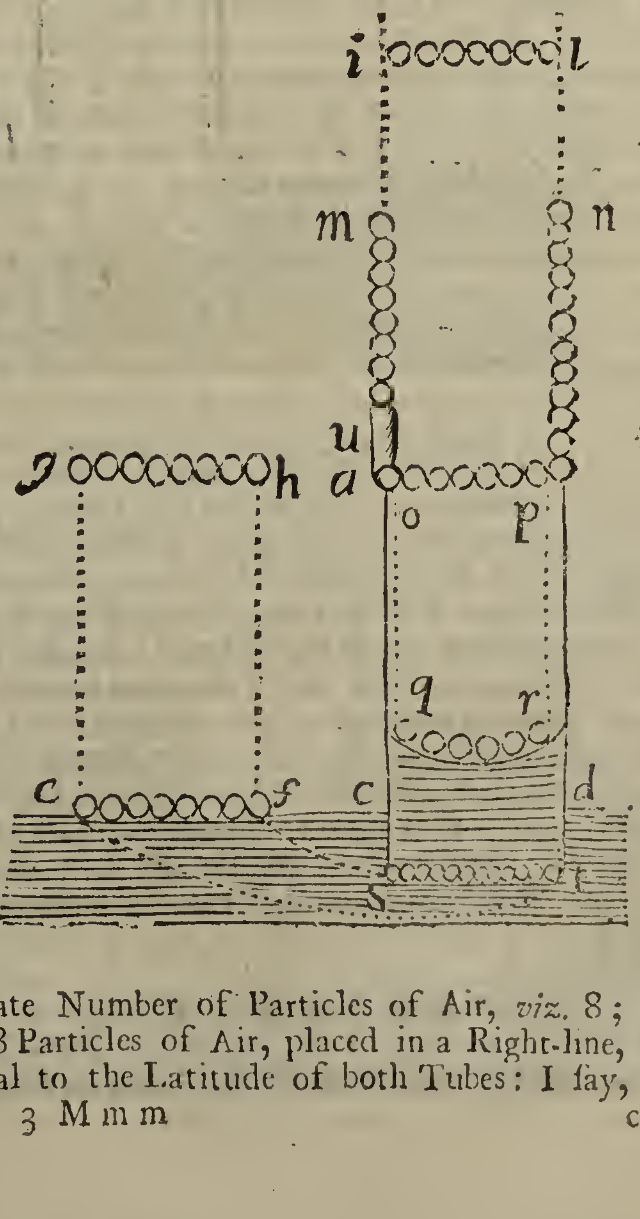
Rohault, in the Firſt Part of his Phyſicks, *Cap.* 22. *Sect.* 85. tells us, That he thinks this Phænomenon may be thus accounted for: He fancies, That the Particles of Air cannot move ſo briſkly in ſlender Pipes, as in larger; and conſequently, are hinder'd from exerciſing a Force ſufficient to ſuppreſs the Water.

Tho' had but this Gentleman made the ſame Experiment with Mercury, he would have found the quite contrary Effect, and that the Mercury in ſmall Tubes is depreſs'd below the Mercury without.

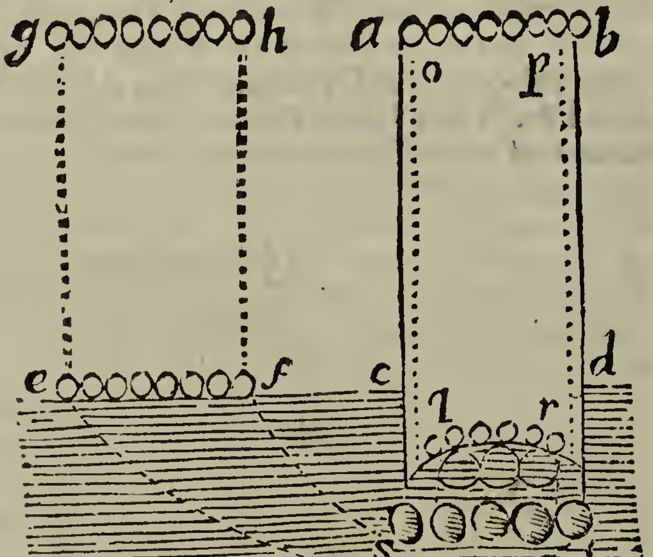
Beſides, his Solution will appear precarious to any one that conſiders the Thing; for I wonder what a free Motion of the Particles of Air hath to do in depreſſing or elevating Liquors contain'd in Tubes: This is certainly the Effect of Gravity, whoſe Action is Rectilinear; but this Rectilinear Preſſure is no more hinder'd in ſmall Tubes than in larger.

And therefore the Reaſon why Water in ſmall Tubes riſes higher than the Level of the Surface without, according to Hydroſtatical Principles, muſt be either becauſe the Preſſure without is increaſed, or the Preſſure within the Tube diminiſhed; but the Preſſure without does not ſeem to be increaſed by barely putting the Tube into Water, and therefore it follows, the Preſſure within is leſſen'd: How this can be, is now to be accounted for.

Let there be a ſmall Cylindrical Tube, *a b c d*, immerſed in the Surface of the Water *e d*, upon which Surface let the Cylinder of Air *e f g h* likewiſe inſiſt: Then let us ſuppoſe, that upon the Diameter of each Tube can ſtand a certain determinate Number of Particles of Air, *viz.* 8; or let 8 Particles of Air, placed in a Right-line, be equal to the Latitude of both Tubes: I ſay, it



can ſeldom, nay, I believe, it can never happen that the Eight can be intromitted in the Cavity of the Tube; for the upper Edges of the Tube will intercept the Firſt and Eighth, ſo that only ſix can fall upon the Water: And the ſame will hold true of any other Series of Globules, whoſe two Extreme Particles will always fall upon the Brinks of the Tube. Hence it is, that the whole Round of Globules inſiſting upon the Edges of the Tube, together with *a m* and *b n*, which they perpendicularly inſiſt upon, gravitate only upon the Edges of the Tube, and never come to the Water *q r*, which is only gravitated upon by a Cylinder of Air, whoſe Diameter conſiſts of ſix Globules: But 'tis quite another thing in the Aerial Cylinder *e f g h*, taken in any Part of the Surface without, where the Extreme Globules are not intercepted by the Sides of the Cylinder *g e* and *e h*, which are purely imaginary, but act freely upon the ſubjected Liquor: Conſequently the Fluid without, is more acted upon than the Fluid within, by how much the Series of Globules inſiſting upon this, exceeds the Series of Globules inſiſting upon that; ſo that the Liquor without muſt ſubſide a little, forcing that within the Tube to aſcend, till ſuch time as the Preſſure be every where equal: But this is ſcarce perceivable in Tubes of larger Diameters; for the Air inſiſting upon the Brinks of a Tube, bears a greater Ratio to the Air without, whoſe Preſſure is not hinder'd, in ſmall Tubes than in larger, as the ſubſequent Calculation will make appear.



Let the Diameter of the Aerial Cylinder *e g h f* be 7 Globules, and that of the Cylinder *o p q r* be 6 Globules; then the Area of the Baſe of the former will be $38\frac{1}{2}$, and that of the latter $28\frac{1}{7}$, whoſe Difference is $10\frac{3}{14}$; ſo that *e f* is preſt upon above $\frac{1}{4}$ more than the Baſe of the latter *c d*: But if the Diameter of the Baſe of the External Cylinder be 14 Globules, and that of the Internal one a Globule leſs, *viz.* 13, the Area of the former will be 154, and that of the latter $132\frac{11}{14}$, whoſe Difference will be $21\frac{3}{14}$; ſo that the Preſſure of that is now ſcarce $\frac{1}{8}$ part greater than the Preſſure of this: From whence it appears, That the Difference of Preſſure is a great deal leſs in large Tubes than in ſmall.

Upon the ſame Principles 'twill follow, That lighter Liquors will riſe higher in ſmall Tubes than heavier: And now we ſhall give an Account, why Mercury in a very ſmall Tube ſhould ſubſide below the Level of the external Mercury.

And here it may not be improper to obſerve, That ſome People, from the Aſcent of Liquors in ſmall Tubes, have vainly hoped for a perpetual Motion; for, ſay they, 'tis but making a Tube extremely ſmall, and not too long, and then the Aſcent of the Liquor being proportional to the Smallneſs of the Tube, 'twill flow out at the Top, and that continually: But had thoſe People but throughly conſider'd the Matter, they could not have drawn any ſuch Concluſion; for though the Liquor contained in the Tube be forced to the Top of the Tube, by reaſon of a leſs Preſſure; yet when it comes to the Top, it meets there with the Globules which before acted only upon the Edges of the Tube, and conſequently is hinder'd from overflowing, the Preſſure above and below being equal.

But here it may very well be objected, That tho' the Aerial Cylinder *g h e f* preſs upon the ſubjected Liquor, yet this Preſſure is not wholly derived to the Tube, but partly broken; for the Globules of Water *s t*, cannot ſo exactly flow into the Tube, but the extreme Globules *s* and *t*, muſt light on the Edges of the Bottom of the Tube, and conſequently their Preſſure be rendred ineffectual, as were *a* and *b* above; and this being true of the whole Round of Globules, they ſee no reaſon why the Water ſhould aſcend at all, being the Preſſure is equally debilitated both above and below.

To obviate which Objection, it may be conſidered, That the Particles of Water are more voluble and flexible; upon which account they eaſily glide into the Tube, without ſuffering any conſiderable Detriment; whilſt thoſe of Air, being more ſtiff and rigid, ſuffer much from the Sides of the Tube: Beſides, the Particles of Water are ſmaller than thoſe of Air, as Mr. *Boyle* has prov'd by ſeveral Experiments, and conſequently, though the extreme Globules *s* and *t* do light upon the Edges of the Tube, yet ſtill the Preſſure upwards will be greater than the Preſſure downwards, and the Water forc'd to aſcend.

Theſe Things being conſidered, 'twill be no difficult Matter to account for the ſubſiding of Mercury in ſmall Tubes below the Level of the Mercury without; for by the Law of Contraries, the Particles of Mercury will be more groſs than thoſe of Air; and conſequently the Preſſure of the Particles of Mercury below, upwards will be leſs than the Preſſure of the Air down, and the Mercury forced to deſcend.

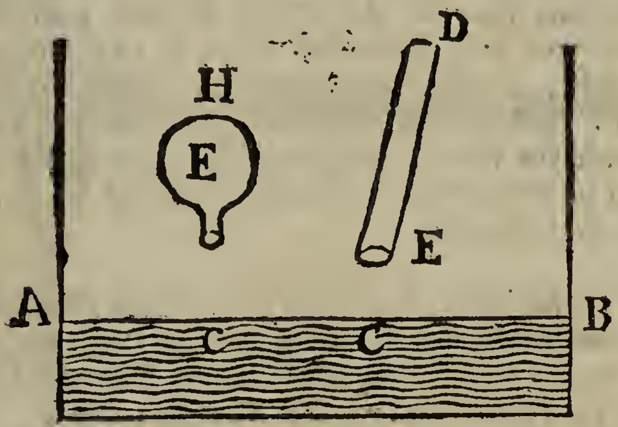
LEMMA.

Hitherto we have only taken notice of the Gravity of the Air, without any regard to that other remarkable Property of *it*; I mean its Elaſticity, which Mr. *Boyle* has prov'd by various Experiments. Now this Elaſticity is a Power that Air compreſſed, either by its own Gravity, or any other way, has of reſtoring it ſelf to its former State; and this Elaſtick Force acts indifferently every way, though in caſe any Part of the compreſſed Air be leſs preſs'd upon than the reſt, 'twill that way endeavour to free it ſelf from the Preſſure upon its other Parts, in order that the Preſſure may be equal every where; and this reſtitutive Force increaſes in proportion to the Compreſſive, and is always equal to it.

If any one deſire a fuller Account of this Matter, he may conſult Dr. *Wallis's Mechanical Philoſophy, P.* 1. *C.* 13. *Pr.* 1. and *L.* 14. *Pr.* 11. This being premiſed, I proceed to the following Propoſition.

PROP. VI.

The Elaſtick Force of Air contain'd in any Veſſel, and which is of the ſame Nature with the external Air, i. e. *is neither more nor leſs compreſt, does the ſame thing as the whole Weight of the external Air.*



Let there be a Tube, as *D*, or a Veſſel, as *H*, of any Form, whoſe Orifice at *E* is open, and conſequently the internal Air communicates with the external; then 'tis plain, that if the external Air be more compreſt than the internal, it will dilate it ſelf, compreſſing the internal till ſuch times as there be an *Æquilibrium*; but on the contrary, if the internal be more compreſt than the external, then will this dilate it ſelf, compreſſing the other till the *Equilibrium* be again reſtor'd; *i. e.* till the Elaſticity of the included Air be equal to the compreſſive Force without; or, which is the ſame thing, to the whole Weight of the incumbent Air: And if *E* be cloſe, the Elaſticity of the included Air will ſtill be equal to the Weight of the external incumbent Air; for the Elaſticity wont be in the leaſt altered by the Orifice being ſtopp'd; therefore the Propoſition is clear.

PROP. VII.

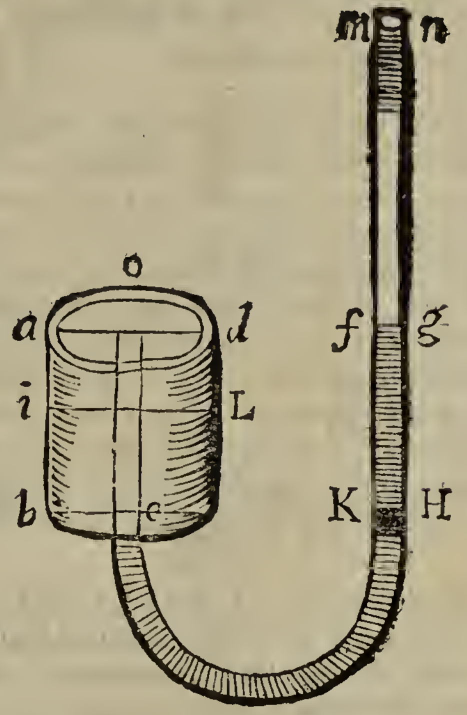
If the Orifice E, *of the Tube* D, *or the Veſſel* H, *(fill'd with Air of the ſame Nature with the external Air) be put in the Surface* A B *of a Veſſel of Mercury, that Fluid will neither riſe nor be depreſt.*

Demonſtration.

For *C*, that part of the Surface *A B* which the Orifice *E* inſiſts upon, is equally preſt with the other Parts of the Surface *A B*, ſeeing the Elaſticity of the Air in *D* and *H*, is equal by the laſt Propoſition, to the Weight of the external incumbent Air; (Here it muſt be obſerved, that we ſuppoſe the Veſſel to be ſuſtain'd ſome other way) and conſequently, by *Prop.* 1. the Mercury will neither aſcend nor deſcend. *Q. E. D.*

The Ingenious Mr. John Keil *thus Mathematically demonſtrates the Reaſon, why* Fluids *keep at the ſame Height in Canals, or Pipes of different Dimenſions.*

Let there be a larger Pipe or Cylinder, as *a b c d*, which is connected with the more ſlender one *m n K H c*, at *c*.



Water being put in at either Orifice, will keep the ſame level in both Pipes, or will ſtand at the ſame Height in both Legs; ſo that the Surface of the Water, *a d* and *g f*, ſhall be in the ſame Plain.

For if by any Force the Water in the larger part *a d b c* ſhould be impelled down, ſuppoſe to *I L*, it muſt riſe ſo much higher in the leſſer Leg of the Siphon, ſuppoſe to *m n*, that the Cylinder of Water *m n f g* ſhall be equal to the empty part *a d i L*.

But when Cylinders are equal, and are of different Baſes and Heights, their Baſes and Heights muſt be reciprocally proportional; therefore here *f m* : *a i* : : As the Orifice *a d* : To the Orifice *m n* or *f g* : But *f m* : *a i* : : As the Velocity of Aſcent in one Tube : Is to the Velocity of Deſcent in the other; and the Orifice *a d* : Is to the Orifice *f g* : : As the Water in *a c* : Is to the Water in the part of the Pipe *f H*, (for Cylinders of equal Height are as their Baſes:) Wherefore the Velocity of the aſcending Water in the Pipe *f H*: Will be to the Velocity of the deſcending Water in the Pipe *a c* : : As the Water in the Pipe *a c* : Is to the Water in the Pipe *f H*; that is, the Velocities of the aſcending and deſcending Portions of Water are reciprocally proportional, and conſequently their Moments muſt be equal; and being contrary one to another, they will equi-balance each other, and conſequently make the Water ſtand in both Legs at one and the ſame Height.

The Phyſical Reaſon of which Phænomenon is, That no more Water preſſes on the Orifice *c*, than what is contained in the Cylinder *o c*, perpendicularly incumbent on the Orifice (the reſt being ſuſtained by the Bottom of the larger Pipe, which extends beyond the Orifice *c* all round it): Now the Cylinder *o c* being equal every way to *f g*, the Water in each will be of the ſame Height.

From hence alſo, by the by, may the Reaſon appear, Why Water, or any other Fluid, flowing out of a larger Pipe or Canal into a ſlenderer, moves there with a greater Celerity.

Hence alſo in an Animal Body, if the Ramifications of the Arteries (or the Capillary Arteries) have the Sum of all their Orifices, or rather of their Tranſverſe Sections, greater than the Area of the Tranſverſe Section of the *Aorta*, or great Artery,

tery, the Velocity of the Motion of the Blood in them will be leſs than in the Aorta ; but if the Sum be leſs, the Motion of the Blood there will be ſwifter than in the Aorta.

HYDROSTATICKS. Weights which force out of the ſame Tube equal Quantities of the ſame Fluid, are to one another as the Squares of the Times in which the Fluid is forc'd out : But if the Times are equal in which the ſame Quantity of the Fluid is forc'd out thro' unequal Tubes ; then the Powers are reciprocally as the Orifices of the Tubes : And therefore Powers which thruſt out the ſame Quantity of a Fluid through unequal Tubes, are to one another in a reciprocal Proportion, compounded of the Squares of the Times, and of the Orifices of the Tubes.

HYDROSTATICAL-BALLANCE. *A Deſcription of an* Hydroſtatical-Ballance, *for finding the Specifick Gravities of Liquids and Solids with Eaſe and Accuracy. By* F. Hawkſbee, *in* Vine-Office-Court *in* Fleet-Street.

For LIQUIDS.

A A is the Foot to which the upright Piece or Prop *B B* is to be ſcrew'd : (See *Fig.* 1.) To the upper End of this upright Piece is faſten'd a double Check of Steel, *C C*, on which the Beam *D D* is ſuſpended. To one End of this Beam put on the General Scale, expreſs'd by *E E.* At the other End of it, hang on the other Scale, which is a very thin and light one, and is only expreſs'd on the Ballance by the Characters of *F F.* To the Loop at Bottom of it, is to be ſuſpended by its Hair, and the Bottle *G G.* Thus prepared, the Bottle being plung'd into the Glaſs of Water, *H H*, the Beam will form an Horizontal Poſition : But if it happen ſomething too light, or too ponderous, (for all Waters have not the ſame Specifick Gravity, nor at all Times) it muſt be adjuſted by putting Weights on the lighteſt End, 'till brought to an *Equilibrium.* Theſe Weights, in the Experiment, are to be taken no notice at all of. And by an Experiment, by and by to be mention'd, I found two Grains to be the greateſt Variation, between the Weight of a Bulk of Water, equal to 574 Grains, at the greateſt Degree of Heat in this Climate to the Freezing Point. And thus you may find the Specifick Gravities of all manner of Liquids, in compariſon to their like Bulk of common Water : For the Bottle will ſink down in *lighter*, and be buoy'd up in *heavier* Fluids ; and the Grains, or Part of Grains, which muſt be put into one of the Scales, to reduce the Beam to an Horizontal Poſition, will ſhew the Difference of the Specifick Gravity.

For SOLIDS.

The General Scale *E E* remains in its Place : But inſtead of the Scale *F F* muſt be ſuſpended the Braſs Piece, repreſented by the Figure *I I.* (See *Fig.* 2.) To the Loop, at the Bottom of which, muſt the Glaſs Bucket *K K* be ſuſpended by its Hair, which then becomes a Ballance to the other End. Into this Bucket muſt be put the Solid (whatever it be) whoſe Specifick Gravity you would find, or whoſe Weight you have a mind to compare with that of the like Bulk of Water : And having ballanc'd it by Weights at the other End, take it out of the Bucket, and plunge the Bucket empty into the Water. Then putting the Braſs Diſh *L L*, by its Slit on the Braſs piece *I I*, a Notch being cut in't to receive it ; the Bucket then in the Water will be *in Æquilibrio* with the General Scale *E E.* The Diſh *L L* being the Weight of a Bulk of Water, equal to the Solidity of the Bucket : But if it chances to vary a little, you muſt reduce it as before. Then putting the Solid Body into the Bucket, (having firſt well wetted it all over in Water ; and it be irregular, take care that no Air lodges in any part of it) then you will ſoon find what it has loſt of its Weight, in compariſon to what it weigh'd in the Air : And by the Difference of which Weights, divide the Weight firſt found, which exactly gives you its Proportion to the like Bulk of Water. See *Specifick Gravity.*

An Experiment, touching the different Denſities of common Water, from the greateſt Degree of Heat in this Climate to the Freezing Point ; obſerv'd by a Thermometer. By Mr. Hawkſbee.

I took about a Quart of common Water, and gave it a pretty conſiderable Degree of Heat over the Fire : Then putting it into a convenient Glaſs together with my Thermometer, where the Spirit ſoon aroſe into the ſmall Ball a-top, and continued to remain there till the Water began to abate of its Heat ; by which Time the Spirit in the Thermometer became of an equal Degree of Temperature with the Water in which it was plac'd. When the Spirit has deſcended to 130 Degrees above the Freezing Point, (which is the greateſt Height it has been obſerv'd in this Climate) I began my Obſervations, and found that the Bulk of Water, equal to that of the Bottle I weighd in't in that State was equal to 574 Grains, at 80 Degrees above the Freezing Point, the Bulk of Water, equal to the Bottle, then weigh'd $\frac{3}{4}$ of a Grain more than before : At 32 Degrees above the pre-mention'd Point, the like Bulk of Water equal to the Bottle, was again increaſed $\frac{3}{4}$ of a Grain ; at the Freezing Point it weigh'd about $\frac{1}{2}$ of a Grain more : In all about 2 Grains, from 130 Degrees above the Freezing Point, to the ſame Point : Which to me ſeems very conſiderable, and ought to be obſerv'd by thoſe, who at different Seaſons, have occaſion to find the Specifick Gravities of Liquids and Solids.

HYDROTICKS, [ὑδροτικὰ of ὕδωρ, Gr. Water] or Medicines that provoke Sweating, are thoſe which by fermenting and attenuating the ſmall Parts, penetrate into the cloſeſt Pores of the Blood, divides its Particles, rarify them, and turn them into a kind of Vapour, which, together with whatever they meet, and can carry with them, they drive out into the Surface of the Body, and there being condens'd into an inſenſible Liquor, they appear in the Form of Sweat. *Blanchard.*

HYEMAL *Solſtice* : See *Solſtice.*

HYGIEA, [ὑγιεα, Gr.] is Health, which conſiſts in a good Temperature, and right Conformation of Parts.

Health is a Diſpoſition of the Parts of an Human Body, fit for the Performance of the Actions of that Body.

This muſt be placed
at the Word Hydreſtaticall Ballance.

Fig: I.

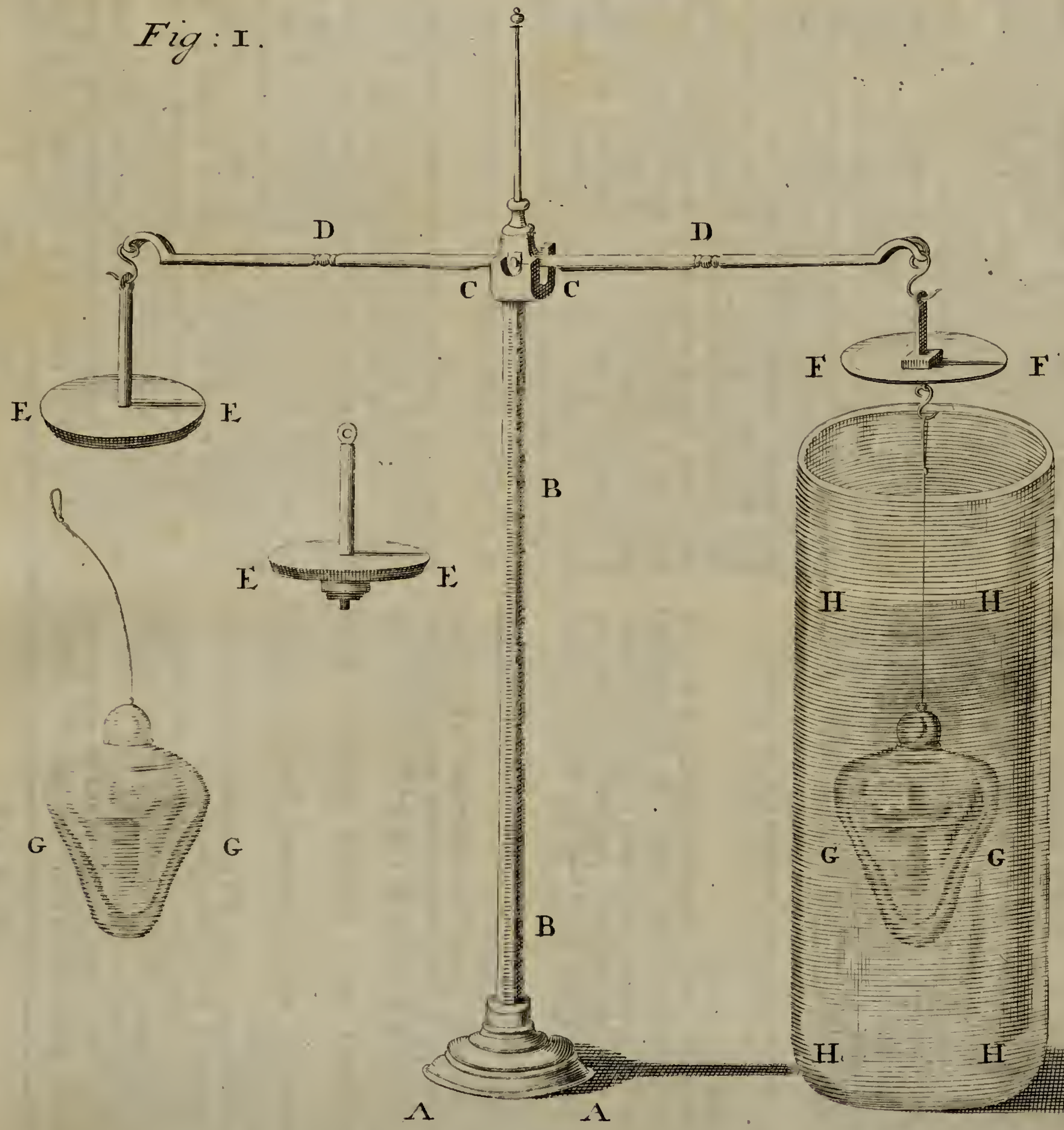
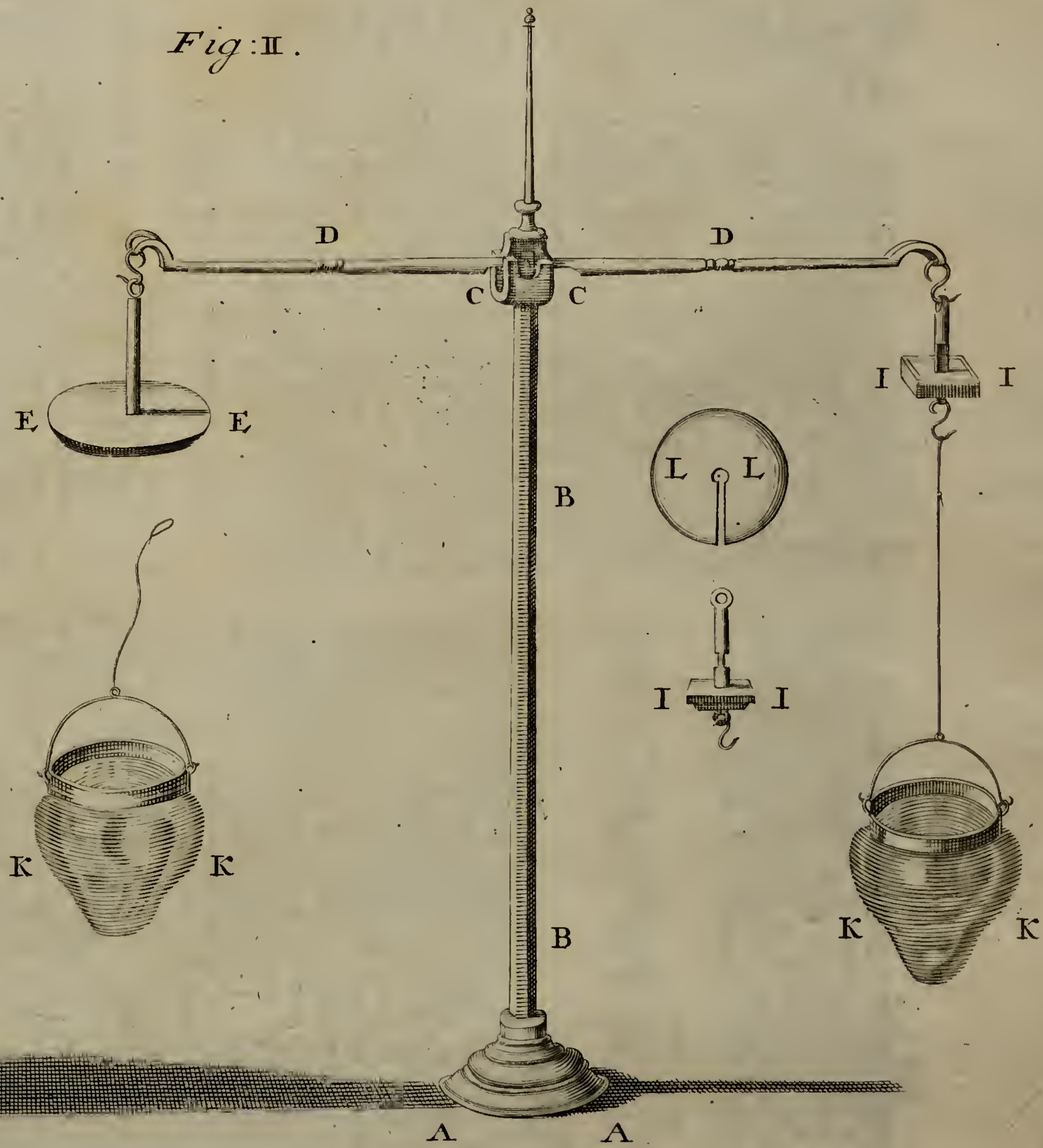


Fig: II.



Signs of Health are Three, due Action, ſuitable Qualities, and when Things taken in and let out are proportionable. *Blanchard.*

HYGIEINA, [ὑγιείνη, Gr.] is that Part of Phyſick which teaches the way of preſerving Health: Some divide it into three Parts.

Prophylactick, which takes Notice of future imminent Diſeaſes.

Synteritick, which preſerves preſent Health: And,

Analeptick, which recovers the Sick. *Blanchard.*

HYGROCYRSOCELE, [of ὑγρὸς moiſt, and κιρσοκηλη, Gr.] is a Branch of any winding Veins, ſwoln with ill Blood, accompanied with other Moiſture. *Blanchard.*

HYGROMETER, the ſame with *Hygroſcope:* Which ſee.

HYGROSCOPE, [of ὑγρὸς and σκοπέω, Gr. to view,] is a Philoſophical Inſtrument, contrived to ſhew the Moiſture or Dryneſs of the Air, according as it abounds with watry or dry Steams; and to meaſure and eſtimate the Quantity of ſuch Moiſture or Dryneſs.

To make a Hygroſcope *with Oil of Vitriol.*

Procure a good nice pair of Scales, not too ſlight, that will turn with about $\frac{1}{18}$ part of a Grain, (or $\frac{1}{9}$ part of a Grain will do pretty well) into one of theſe in a flat Glaſs of about 3 or 4 Inches in Diameter (ſuch a kind of Glaſs as holds the ſtagnant Mercury in the Baroſcope) put 3 or 4 Drams of the Oil of Vitriol; hang up the Balance in a place free from the Heat of the Sun's immediate Beams, or a Fire; and put Weights in the other Scale, to reduce it to an *Æquilibrium*, you will be ſurprized to find that this Liquor will, if it was good, and well dephlegmated, double; nay, perhaps treble the Weight in a Fortnight, by attracting and imbibing the Moiſture of the Air: But ſo it will certainly do more or leſs, according to the Seaſon of the Year, and the Temper of the Weather. You muſt let this Liquor hang till you find it hath gain'd its utmoſt Increaſe of Weight, which will be in leſs than a Fortnights time, unleſs it be exceeding dry and hot Weather.

And then you may begin to make uſe of it as an *Hygroſcope:* For as the Oil of Vitriol preponderates, the Air increaſes in Moiſture; and as the other Scale, where the Weights are, preponderates, its Drought increaſes in the ſame Proportion. The Degrees of Moiſture, or Dryneſs, may be computed either by ſmall Weights put into the lighter Scale, or elſe by having the Handle of the Scale very long, as alſo the Tongue; ſo that it ſhall with its Top mark the Diviſions on an Arch of Braſs, that may be applied for that purpoſe on the Top of the Handle, over the Tongue of the Balance.

The Hygroſcope *of Mr.* William Molyneux, *Secretary of the Philoſophical Society at* Dublin, *is thus made:*

Faſten a Piece of Whip-cord, of about 4 Foot long, to an Hook or Staple, in ſome convenient Place of the Ceiling of a Room, and at the Bottom hang a Weight of about a Pound: Let thereon, or into the Bottom of the Weight, be faſtened an Index of about a Foot long, and under it, on a Table, or on a Piece of Board, place a Circle, divided into what Number of Degrees you pleaſe, and fit it ſo that the Centre of the Index may hang juſt over the Centre of the Circle.

After it has hung thus two or three Days to ſtretch the Cord, you may begin to meaſure by it the Degrees of Moiſture or Drought in the Air: For the Cord will twiſt one way, and contract it ſelf for Wet, and untwiſt it ſelf again on the contrary way for Dry. You will find this plain and ſimple Inſtrument the niceſt *Hygrometer* of any, for it will ſhew you very ſmall Alterations of the Temper of the Air, and is ſubject to fewer Inconveniencies than any other Inſtrument of this kind.

A very good Hygroſcope *may be thus eaſily made.*

Take a ſmall Deal-Box, and to the Bottom, or one of the Sides of it, faſten ſtrongly a pretty large Piece of Lute-ſtring or Cats-gut; and then bringing the other End thro' a Hole purpoſely made for it in the oppoſite Part or Side of the Box, and which muſt be ſo much bigger than the String, that the String may turn eaſily round in it any way: Faſten to the String (without) a light Index, made of a Piece of Cedar or Deal, *&c.* and round about the Hole where the String comes thro', draw a Circle on the Box, and divide it into Degrees; ſo that the String twiſting and untwiſting it ſelf, as it will do againſt wet or dry Weather, may turn the Index along with it, and that will ſhew in the graduated Limb of the Circle, the Meaſure of the Air's Moiſture or Dryneſs.

I have often tried this kind of *Hygroſcope*, and found it to do very well. But Dr. *Hook*, in his *Micrographia*, ſaith, Nothing will ſhew the Variations of Moiſture and Dryneſs in the Air like the Beard of a Wild Oat; which he there (*P.* 147.) ſhews you how to fit in a proper Box or Frame, and with an Index, *&c.* But I believe the Cats-gut one, tho' not ſo very tender as this, (and yet I have known one go twice round the ſame way) may retain its twiſting and untwiſting Property much longer.

I always found the Wind to have a peculiar Effect upon this Inſtrument.

Another Hygroſcope *of two Plain Boards.*

Plane two pieces of Deal, or (which is better) of Poplar Boards, of about two Foot long, and a Foot and a half in breadth, and let them be ſhotten or jointed, ſo that their Edges will meet even together; let thoſe be ſet cloſe together like a Pannel of Wainſcot, with their Tops and Bottoms let into the Groove of a ſtrong Oaken-Ledge, and their four outward Corners pointed into the Groove; but there need be no Ledges on the Sides, that the Boards may play the better.

Then, ſince every one knows that theſe Boards will ſhrink very much in exceeding dry Weather, and conſequently gape or open from each other; ſuppoſe the utmoſt Diſtance that they will ſhrink from each other to be a quarter of an Inch, more or leſs, it matters not much. Take a thin piece of Braſs of two or three Inches long, and about a quarter of an Inch broad, and meaſuring at one end of it a quarter of an Inch (or that Diſtance you ſuppoſe your Boards will ſhrink) divide it into five equal Parts, and then with a ſmall File cut thoſe Diviſions into ſo many ſmall Teeth, like thoſe of a Watch-wheel: Then drilling two or three Holes in this piece of Braſs towards the other end, with ſome ſmall Nails faſten it on one of your Boards, ſo that the firſt of the five Teeth may lie juſt over the Juncture of the Boards, and the reſt lie over the other Board. Next on the end of a piece of thick Iron-wire, make a Pinion of three Teeth to anſwer the five Notches in the Braſs Plate; and by means of a Bracket, let it be ſo faſten'd on the other Board, that its Axle playing in the Bracket, it may fit the Teeth of its Pinion to the Notches in the Braſs Plate; and then whenever the Boards ſhrink aſunder, the Braſs being drawn a little away, muſt needs turn this Axle more or leſs; and when the Boards have ſhrunk a quarter of an Inch from each other, the Axle will have made one entire Revolution. If then you faſten a long and light Index on the Extremity of this Axle, and make a Circle round it, divided into what number of Parts you pleaſe, the Motion of the Point of the Index, backwards or forwards, will ſhew you the Degree of Moiſture or Drought in the Air.

You may eaſily have the Axle ſo long, as that its Index-end ſhall come thro' a round Plate of Wood or Metal, which may hide all Contrivances, and make it appear only like a Clock or Watch.

HYGROSCOPE *Statical*, was invented by that Noble Philoſopher Mr. *Boyle*. The beſt way to make it, is to take a Dram Weight of fine Spunge, and having well cleaned it and dryed it, let it be put, when the Air is of a moderate Temperature, into one of the Scales of a very nice and tender Ballance, (that will turn, when ſo loaded, with half a quarter of a Grain) and in the other Scale put ſo much Weight as will juſt equi-ponderate it. Then will the Spunge by its increaſe and decreaſe of Weight, daily ſhew the Moiſture or Dryneſs of the neighbouring Air, and meaſure its Quantity by Weight; whence it hath its Name of the *Statical Hygroſcope*.

I have often tried this Inſtrument my ſelf, and have found it to anſwer very nicely, and to increaſe and decreaſe in Weight very conſpicuouſly, according as the Air hath been Moiſt or Dry.

If you think the taking out or putting in of ſuch ſmall Weights, as Grains, or their Subdiviſions, (of which there will be conſtant occaſion) to be troubleſome, you may eaſily ſo fit the Arch of a Semi-circle well divided, as that againſt it the Tongue of the Ballance ſhall play, and by the Degree there cut, ſhew you the Quantity of the encreaſe or decreaſe in Weight of the Air's Moiſture: But the former way is more exact, and will be eaſy enough with a little Practice.

The above-mentioned Honourable Gentleman hath a little Tract about the Uſes and Advantages of *Hygroſcopes*; wherein he proves this *Statical one* to have many Advantages above the other Kinds. For,

1. It will laſt good longer than moſt of them.
2. As it is eaſily made at firſt, ſo 'tis as eaſily repaired or mended, if it come to any Injury.
3. The Quantity of the Drought or Moiſture of the Air it meaſures, is eaſily communicable to a Correſpondent by Letter, *&c.* becauſe it is eſtimable in the known Weights of Grains and their Parts; whereas in moſt other Hygroſcopes 'tis not ſo eaſy for another Perſon, beſides the Obſerver, to judge of the Quantity of the Alteration.

The Uſes and Advantages of theſe kind of Inſtruments when well made, and carefully obſerved, he judges may be ſuch as theſe:

1. To diſcover in what part of Day or Night the Air hath its greateſt Degree of Moiſture; and how at ſuch times the Baroſcope ſtands affected; whether near the Sea-ſide, the Ebbing and Flowing of the Sea make any ſenſible Alteration as to the Moiſture or Dryneſs of the Air; and whether at the Fall and New Moons the Atmoſphere be moſt damp and moiſt; and whether the Menſtrual or Annual Spring-Tides, have any ſenſible Operation on this Inſtrument.
2. To diſcover how much one Year and Seaſon is drier or moiſter than another; whether the multitude or fewneſs of Solar Spots occaſion (as ſome Aſtronomers have obſerved) any Alteration in the Temperature of the Air, as to Wet or Dry: And thoſe that are Aſtrologically given, may obſerve, whether the Aſpects of the Planets, their Eclipſes, Conjunctions, *&c.* have any Influence this way on our Atmoſphere.
3. To diſcover and compare the Changes of the Temperature of the Air made by Winds, ſtrong or weak; or by Froſty, Snowy, or other Weather.
4. To compare the Temperature of differing Houſes, and differing Rooms in the ſame Houſe; which may be of great Uſe to tender and ſickly Perſons; and to keep a Chamber, if there be occaſion, conſtantly to the ſame, or any aſſigned Degree of Dryneſs.

HYLE }
HYLEC } [in *Alchymy*] firſt Matter, or Matter conſidered as produced by Nature herſelf, the Chaos.

HYLEG }
HYLECH } [in *Aſtrology*] a Planet in a Perſon's Nativity, which is accounted to be the Moderator and Significator of Life.

HYLEGIAL *Places* [in *Aſtrology*] are thoſe Places in which when a Planet happens to be ſet, it may be ſaid to be fit to have the government of Life attributed to it.

HYMEN [ὑμέναιος, Gr.] is a circular folding of the inner Membrane of the *Vagina*: and this being broke *(in primo Coitu)* its Fibres contract in three or four Places, and ſo form the *Glandulæ Myrtiformes*.

HYMEN [in *Anatomy*] a thin Membrane or Skin reſembling a piece of fine Parchment, ſuppoſed to be ſtretch'd in the neck of the Womb of Virgins below the *Nymphæ*, which is broken when they are firſt Deflower'd, an effuſion of Blood following the Breach, and is generally accounted the Teſt of Virginity.

HYMEN [in *Botany*] a fine delicate Skin, in which Flowers are incloſed while they are in the Bud, and which burſts as the Flower blows or opens.

HYOIDES [of ὑοειδής, Gr.] and by ſome, *Os Upſiloides*, from its being in Figure like the Letter *Y*, is a Bone placed at the Baſis of the Tongue upon the *Larynx*: It has ten Muſcles which keep it in its Place above by its upper *Cornua*; 'tis faſtened to the *Apophyſes Styloides* of the Temple-Bone, and below to the Wings of the *Cartilago Thyroides* of the *Larynx*.

HYOTHYROIDES [of ὑοειδὲς and θυρεοειδὲς, Gr.] are two Muſcles of the *Larynx*, proceeding from the inferior Part of the Bone *Hyoides*, laterally and oppoſite to the Origination of the *Ceratogloſſus.*

This pair of Muſcles deſcends directly to the lower part of the *Cartilago Scutiformis* : Its Uſe is to draw the *Larynx* upwards in an acute Tone of the Voice ; the Canal of the *Aſpera Arteria* being alſo ſtraitned by it.

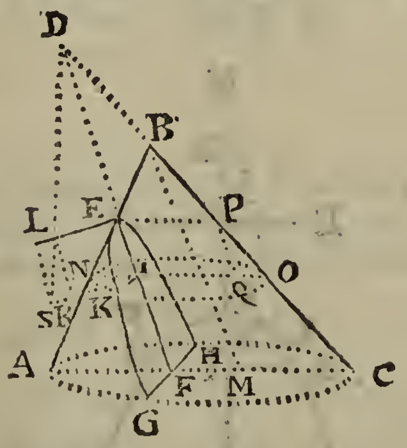
HYPÆTHRON, is an open Gallery or Building, the inſide whereof is uncover'd, and expoſed to the Weather. The Antients gave this Name to all Temples which had no Roof ; as that of *Jupiter Olympius* at *Athens*, having ten Columns in Front, as alſo two Rows in its exterior Sides, and one in the interior.

HYPALLAGE [ὑπαλλαγὴ, Gr.] or *Immutation*, a Grammatical Figure, when of different Expreſſions, which give the ſame Idea, we make choice of that which is leaſt uſed ; or when there is a mutual Permutation or Change of Caſes : As in this Inſtance, *Dare Claſſibus Auſtros*, inſtead of *Dare Claſſes Auſtris.*

HYPERBATON [of ὑπερβαίνω, Gr. to tranſcend,] a Grammatical Figure, where there is too bold and frequent a Tranſpoſition of Words.

HYPERBOLA [ὑπερβολὴ, Gr.] in *Geometry*, is a Section of a Cone made by a Plane, ſo that the Axis of the Section inclines to the oppoſite Leg of the Cone, which in the Parabola is parallel to it, and in the Ellipſis interſects it. The Axis of the Hyperbolical Section will meet alſo with the oppoſite ſide of the Cone, when produced above the Vertex.

Thus, in the annexed Figure, the Curve *G E H F* is an *Hyperbola.*

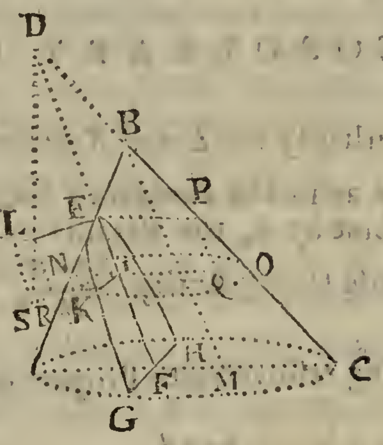


Where the Line *E D*, being the Continuation of the Axis till it meet with the oppoſite Cone, or oppoſite ſide of the former Cone *C B* produced, is called by the Name of the *Latus Tranſverſum* ; and the middle Point of that Line *E D*, is called the *Centre of the Section*, or rather of *the oppoſite Sections.*

PROP. I.

In an Hyperbola G E H F, *the Square of the Ordinate* I K, *is equal both to the Rectangle* L I, *made under the* Parameter L E, *and the* Abſciſſa E I ; *and alſo to the Rectangle* L S, *made under the* Abſciſſa E I, (*or* L R) *and another Line* S R, *which is a fourth Proportional to* D E *the* Latus Tranſverſum, E L *the* Parameter, (*or* Latus Rectum) *and* E I *the* Abſciſſa.

Let the ſide of the Cone $A B$, in which the Section is, be called a ; and thro' B the Vertex of the Cone, draw $B M$ parallel to the Axis of the Section, and which call b. Let the intercepted part of the Diameter of the Baſe $A M$ be called c. Let $E I = e b$. Then by comparing the ſimilar Triangles $A B M$ and $E I N$, $I N$, in this way of Notation, will be $= e c$. And if you put $M C = d$, and the Tranſverſe Diameter $D E = o b$; then will $D I = o b + e b$. And by reaſon of the Similarity of the Triangles $B M C$, $D E P$, and $D I O$, you will find that $E P$ muſt be expreſſed by $o d$, and $I O$ by $o d + e d$, and conſequently, $Q O = e d$. (*The General Reaſon of all which way of Notation, and the way of working to obtain it, you will ſee in the Parabola.*)



This done, 'tis plain that $K I$ Square muſt be $=$ to the Rectangle $N I O$; that is, in this Notation $= o e c d + e e c d$, as you will find by Multiplication. Wherefore, if $o e c d + e e c d$, the Square of $I K$, be divided by the *Abſciſſa* $E I = e b$; the Quotient muſt be ſuch a Line, which, together with $E I$, can make a Rectangle equal to the Square of $I K$: Wherefore the Rectangle $E S = I K$ Square, which in this Notation will be $\frac{o e c d + e e c d}{e b}$, or contractedly, $\frac{o c d + e c d}{b}$.

This done, proceed (as directed in *Cor.* I. *Prop.* I. of the *Parabola*, to find the *Latus Rectum*) by ſaying, As $b : c :: o d : \frac{o d c}{b}$; in Words, As the Parallel to the Section : is to the part of the Diameter of the Baſe intercepted :: So is the *Latus Primarium* : to a fourth Proportional ; 'tis plain, the fourth Term will be one part of the Line $I S$, or in this Notation $\frac{o d c}{b} =$ *Latus Rectum* $R I$ (or $L E$.) And the other will be found thus: As $b : c :: e d : \frac{c e d}{b}$.

Or, according to *Apollonius*'s way of Expreſſion in this Propoſition : As $o b : \frac{o c d}{b} :: e b : \frac{e c d}{b}$; for that will be found to be the fourth Proportional as before : Which is now found out according the Terms of the Propoſition, between the *Latus Tranſverſum* $o b$, and the *Latus Rectum* $\frac{e c d}{b}$, and the *Abſciſſa* $e b$.

Wherefore $o e c d + e e c d$, the Square of the Ordinate $I K$, is manifeſtly equal to the Rectangle under the *Latus Rectum* and the *Abſciſſa* ; and alſo to another under the *Abſciſſa*, and the fourth Proportional. *Q. E. D.*

COROL.

COROLLARY I.

Hence the Reaſon of the Name *Hyperbola*, which *Apollonius* gave to this Section, is apparent, *viz.* Becauſe the Square of the Ordinate *exceeds* the Rectangle under the *Parameter* and *Abſciſſa.*

COROLLARY II.

If you multiply the *Latus Rectum* $\frac{ocd}{b}$ (which is noted here as in the *Parabola)* both above and below the Line by b, the Parallel to the Section, there will ariſe this Quantity $\frac{bocd}{bb}$.

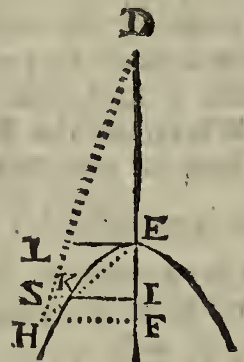
Which being reſolved into Proportionals thus:

As $bb : cd :: bo : \frac{bocd}{bb}$; gives exactly *Apollonius*'s Canon for finding the *Latus Rectum*, (in *Prop.* 12. *Lib.* 1.) *viz.*

As the Square of the Side of the Cone in which the Section is made: Is to the Rectangle between the Segments of the Baſe made by a Parallel to the Section, and drawn thro' the Vertex of the Cone :: So is the *Latus Tranſverſum* : to the *Latus Rectum.*

COROLLARY III.

The *Latus Rectum* may alſo here, as well as in the *Parobola*, be Geometrically found.



If you find firſt HF, a third Proportional to EI the *Abſciſſa*, and to KI (or EF) the Ordinate: (See *Praxis* 2. in the *Parabola.)* After which find a fourth Proportional EL to DI, the Sum of the *Latus Tranſverſum* and *Abſciſſa*, to HF, and to DE, the *Latus Tranſverſum.* For ſuppoſing $IS = HF$ (as it might eaſily have been made, by drawing it a little longer) at the end of which place S, and draw DS; as alſo LE parallel to HF: Then ſhall LE be the true *Latus Rectum*: For as $DI : IS$ (or HF;) :: ſo $DE : LE$.

COROLLARY IV.

From which 'tis plain, that having the *Latus Rectum* and *Tranſverſum*, the Ordinates in any *Hyperbola* may be drawn, and conſequently the Curve eaſily deſcribed.

For taking any part of the Axis (as EI) for the Abſciſſa, and making as $DE : $ to EL :: So DI : to a fourth Proportional IS; and then finding a mean Proportional between IS and the Abſciſſa EI (ſuppoſe IK,) that Line IK rightly applied, ſhall be the Ordinate ſought, thro' whoſe Point K, the *Hyperbola* will paſs.

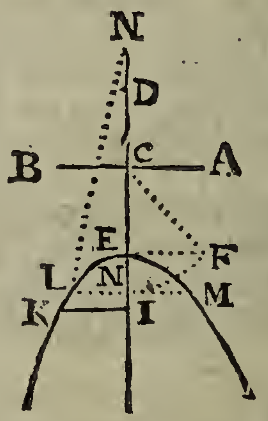
PROP. II.

In the Hyperbola the Squares of the Ordinates K I *and* G F, *are as the Rectangles* D I E *and* D F E, *under the Lines lying between the Ordinates and the Vertices, or Extremes of the* Latus Tranſverſum, *and their reſpective* Abſciſſæ. *See* Fig. Prop. 1.

Let the Axis of the Section EF be called ib, as before EI was called eb: Then, by conſidering *Prop.* 1. 'tis plain, that the Square of GF will be $= oicd + iicd$; and the Rectangle DFE, will (by multiplying $DF = ob + ib$, by $FE = ib$) be found to be $oibb + iibb$.

Again, the Square of KI: will be to the Square of GF:: as $oecd + eecd$; (by *Prop.* 1. equal to it) : is to $oicd + iicd$ (now proved = to the Square GF.) That is, taking away cd, which is common, as $oe + ee$, is to $oi + ii$. But in ſuch very Proportion are the Rectangles DIE and DFE: For $DIE = eobb + eebb$ (becauſe $DE = ob$, and $EI = eb$) and $DFE = oibb + iibb$, as was proved juſt above. Now there is no doubt but $eobb + eebb : oibb + iibbe + ee : oi + ii$; wherefore theſe Rectangles are as the Squares of the Ordinates. *Q. E. D.*

COROLLARY I.



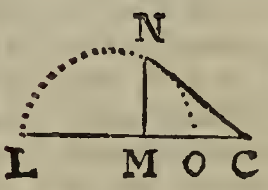
If the *Latus Rectum* LM be applied ſo, as that N be the Focus, then will $LN = \frac{ocd}{2b}$, (and its Square $= \frac{ooccdd}{4bb}$. But (by this Propoſition) As the Square KI : Square LN :: So is the Rectangle DIE : Rectangle DNE; that is, ar $eocd + eecd : \frac{ooccdd}{4bb} :: oebb + eebb$: To $\frac{oocd}{4}$, which will be found to be the fourth Term by this way of Notation. Alſo this Rectangle DNE (being made out of the whole Line DE, with the Part added EN, multiplied by that Part added EN) together with the Square CE, the half of DE ($= \frac{1}{4}$ of $oobb$, i. e. $\frac{1}{4}$ of ob Square) is equal to $\frac{oocd + oobb}{4} = CN$ Square, the half, Line with the Part added: Wherefore CN is the

Diſtance from the Focus $\surd = : \frac{oocd + oobb}{4}$, of which the former Part $\frac{oocd}{4}$, is the fourth Part of the Rectangle under the *Latus Rectum* $(\frac{ocd}{b})$ and *Tranſverſum* (ob); or, as *Apollonius* calls it, the fourth Part of the Figure; and the other Part $\frac{oobb}{4}$ is $\frac{1}{4}$ of the Square of the *Latus Tranſverſum*: So that from hence we may have a Canon to determine the Focus of any Hyperbola; thus,

Add the Fourth Part of the Figure (or of the Rectangle under the *Latus Rectum* and *Tranſverſum)* to the Square of half the *Latus Tranſverſum*; and extract the Square Root of the Sum, that Root ſhall be the Diſtance of the Focus from the Centre $= CN$. And if from CN you take half the *Latus Tranſverſum* CE, the Remainder EN is the Diſtance of the Focus from the Vertex.

Which Rule is very eaſy in Practice, for $\frac{oobb}{4}$ is nothing but the Square of CE, and $\frac{oocd}{4}$ is only $\frac{1}{4}$ of DE multiplied into LM.

Wherefore find a mean Proportional between $\frac{1}{4}$ of $DE = MO$, and LM, which let be MN (in this Figure.)



And then make $MC = CE$ of the Hyperbola; for then ſhall the Hypothenuſe NC, be the Diſtance from the Centre C to the Focus N required.

COROLLARY II.

Since the Rectangle DNE + Square $CE =$ Square CN, therefore the Square CN — Square $CE =$ Rectangle DNE: Put therefore, for Brevities ſake, $m = CN$, and then will the Rectangle $DNE = mm - \frac{oobb}{4}$ in this Notation, of which more below.

PROP. III.

In the Hyperbola (See Fig. of Prop. 1.) *the* Latus Rectum : *is to the* Latus Tranſverſum :: *as the Square of any Ordinate* I K : *is to the Rectangle* D I E, *contained under the Lines intercepted between it and the Vertexes of the* Latus Tranſverſum *and the* Abſciſſæ.

For here (as above) $\frac{ocd}{b} =$ *Latus Rectum*, $ob =$ *Latus Tranſverſum*, and $oecd + eecd$, will be $= KI$ Square; and the Rectangle DIE is $= eobb + eebb$; wherefore place thoſe Terms according to the Condition of the Propoſition; as

$$\frac{ocd}{b} : ob :: oecd + oecd : eobb + eebb.$$

And trying by Multiplication of the Extremes and Means, you will find the ſame Quantity $eoocbd + eebocd$ ariſe from both, and therefore the Terms are truly proportional. *Q. E. D.*

COROLLARY I.

In the *Hyperbola* (See *Fig.* 1. of *Cor.* 1. of *Prop.* 2.) if AC Square, or its equal FE Square ($= \frac{oocd}{4}$, which is $\frac{1}{4}$ of DE multiplied into LM) be taken out of CF Square, or its equal CN Square, (*i. e.* out of $\frac{oocd + oobb}{4}$, by *Cor.* 1. *Prop.* 2.) there will remain $\frac{oobb}{4}$, whoſe Square Root is $\frac{ob}{2} = CD =$ half the *Latus Tranſverſum* DE.

Wherefore here, if the Axis be given, the *Foci* are ſo too: For draw thro' the Vertex E, EF perpendicular to ED, and equal to CA, and with the Diſtance CE, ſetting one Foot of the Compaſſes in C, croſs the Axis at N and N; ſo ſhall theſe Points be the *Foci* required.

COROLLARY II.

Since (by *Cor.* 1. *Prop.* 2.) the Rectangle $DNE = \frac{oocd}{4}$; which Quantity $\frac{oocd}{4}$, is alſo (by *Cor.* 1. of this *Propoſition)* proved equal to AC Square; 'tis plain the Rectangle $DNE = AC$ Square, or to a *fourth Part of the Figure*, as *Apollonius* calls it.

COROLLARY III.

Hence 'tis plain, That the Square of CE, half the *Tranſverſe Diameter* : is to the Square of AC or EF, half the *Second Diameter*, as 'tis called :: as the *Latus Tranſverſum* : to the *Latus Rectum*.

For $\frac{oobb}{4} : \frac{oocd}{4} :: oobb : oocd :: obb : ocd :: ob : \frac{ocd}{b}$.

COROLLARY IV.

Again, Since CE Square : AC Square :: ob : $\frac{ocd}{b}$ (by *Cor.* 3.) that is, As the Rectangle DIE : IK Square (by this *Propoſition)* :: the Square of half the *Tranſverſe Diameter* : is to the Square of half the *Second Diameter*; (or, by *Cor.* 2. to the Rectangle $ENE = AC$ Square) :: as the Rectangle DIE : to the Square of the Ordinate IK.

COROLLARY V.

Hence the Square of the Ordinate KI (*Prop.* 3.) which hitherto in the Hyperbola hath been denoted by $oecd + eecd$, (See *Prop.* 1.) may receive a new a new and uſeful Notation, thus: Since $CE = \frac{ob}{2}$ its Square will be $\frac{oobb}{4}$; ſay therefore, As CE Square: to the Rectangle DNE :: Rectangle DIE: to a fourth Term, which will be the Square of the Ordinate IK; and in this Notation it will ſtand thus;

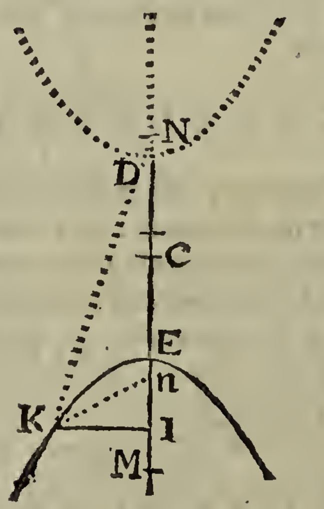
As $\frac{oobb}{4} : mm - \frac{oobb}{4}$ :: ſo is $oebb + eebb$: to $\frac{4emm}{o} + \frac{4eemm}{oo} - oebb - eebb$; ſo that the Square IK is equal to $\frac{4emm}{o} + \frac{4eemm}{oo} - oebb - eebb$. The Uſe of which will follow in the next Propoſition.

PROP. IV.

In the Hyperbola, the Difference between the Right Lines K N *and* K n, *drawn from the ſame Point in the Curve to both the Foci, is always equal to the Tranſverſe Diameter or Axis* D E.

From the Point K in the Curve, let the Ordinate KI be applied; then will EI be the *Abſciſſa*, and noted eb: Let CN or Cn, the Diſtance from the Focus to the Centre, be called m, as in *Cor.* 2. of *Prop.* 2. then will $IN = CI + CN = \frac{1}{2}ob + eb + m$; and $In = CI - Cn = \frac{1}{2}ob + eb - m$.

Square each, and IN Square $= \frac{1}{4}oobb + oebb + eebb + obm + 2ebm + mm$: And In Square $= \frac{1}{4}oobb + oebb + eebb = obm - 2ebm + mm$.



To each of which Squares add the Square of the Ordinate IK, which in this Notation will be found to be $\frac{4emm}{o} + \frac{4eemm}{oo} - oebb - eebb$. (See *Cor.* 5. of *Prop.* 3.) and there will ariſe the Square of the Hypothenuſes $KN =$ to $\frac{1}{4}oobb + obm + 2ebm + mm + \frac{4emm}{o} + \frac{4eemm}{oo}$, and of $Kn = \frac{1}{4}oobb - obm - 2ebm + mm + \frac{4emm}{o} + \frac{4eemm}{oo}$.

Out of which Quantities extract the Square Roots, as may eaſily be done, and there will be found,

$$KN = \tfrac{1}{2}ob + m + \frac{2em}{o};$$

And

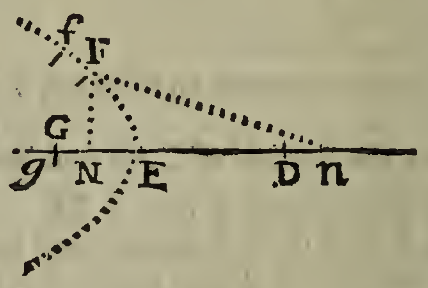
$$Kn = \tfrac{1}{2}ob - m - \frac{2em}{o}:$$

Whoſe Sum is juſt ob. *Q. E. D.*

N. B. Tho' the laſt, $Kn = \frac{1}{2}ob - m - 2em$, be an impoſſible Equation, yet 'tis no matter here, becauſe all the parts, but $\frac{1}{2}ob$ are loſt in the Addition.

PROBLEM I.

To deſcribe an Hyperbola, having the Tranſverſe Diameter D E, *and the Foci* N *and* n *given.*



From N, at any convenient Diſtance, as NF, ſtrike an Arch, and keeping the Compaſſes at that Diſtance with one Foot in E, mark the Point G in the Axis continued; then with the Length GD, and one Foot in n, croſs the former Arch F, ſo ſhall you find a Point which is in the *Hyperbola*: And by this Method repeated, you may find another Point f further on, and ſo many as you pleaſe. The Reaſon of which is evident from this *Propoſition*.

PROP. V.

Let the Second Axis *or* Conjugate Diameter *of the Hyperbola* B A *be brought down and placed at the* Vertex *parallel to the Ordinates, as* O P; *then if from the Centre* C, *you draw thro' the Points* O *and* P *two Right Lines running on infinitely: And after this draw a Parallel to this Diameter within the* Hyperbola, *as* Q R, *I ſay,*

It will be plainly demonſtrable,

I. *That the Parts of the produced Ordinates* G Q *and* H R, *intercepted between the Curve and the Aſymptotes, will always be equal.*

For the Triangles EP and CFR, being ſimilar, as alſo CEO and CFQ, it muſt be, As $CE : EO$ (or EP) :: $CF : FQ$ or FR: But OE and EP are equal; wherefore QF, and FR, muſt be equal; from which, taking the equal Ordinates, the Remainders HR, and DG, muſt be equal. *Q. E. D.*

II. *The Rectangle under* QG *and* GR, *(or* RH *and* HQ*) will ever be equal to the Square of* EO $\left(=\frac{oocd}{4}\right)$ *or to a fourth Part of the Figure.*

For the Triangles CEO and CFQ being ſimilar, $CE : EO :: CF : FQ ::$ or as the Square CE : Square EO. That is, (by *Cor.* 3. *Prop.* 3.) as the *Latus Tranſverſum*, to the *Latus Rectum.* That is, by the ſame Propoſition, as the Rectangle DFE, is to FG Square. And CE Square : EO Square :: CF Square: FQ Square. But if from CF Square, you take away the Rectangle DFE, there will remain CE Square (by 6. *E.* 2. *Euclid.*) And if from the Square of FQ you take the Square of FG, there will remain the Rectangle QGR, (by 5. *E.* 2. *Euclid.*) and, as will preſently appear, if you try it Algebraically, after the manner of the Demonſtrations in that Book. Wherefore theſe two Remainders muſt be to each other, as their Wholes, *i. e.* as the Square of CF, to the Square of FQ :: or as CE Square : EO Square; and then it will ſtand thus:

CE □ : EO □ :: CE □ : Rectangle QGR.

Or Inverſely : As,

EO □ : CE □ :: Rectangle QGR : CE □.

That is, the Square of EO, and the Rectangle QGR, have the ſame Proportion to the ſame Thing, and conſequently are equal one to another.

And this will be the Caſe every where, let the Aſymptotes run never ſo far. And ſince the farther you go from the Vertex of the Angle C, the longer muſt the Lines GR, gr, of neceſſity grow, ſince the Rectangle between GR and QG is always the ſame, *viz.* = OE Square, the ſhorter muſt GQ, gq, continually grow; and conſequently decreaſe infinitely, as the others increaſe infinitely; *i. e. The Curve will infinitely approach to the Aſymptote.*

But yet they can never *coincide*, or meet with one another: For if the Points G and Q, or g and q, &c. ſhould ever come to be co-incident, it will be, As the Rectangle $DFE : FG$ Square :: So will CF Square : be to FG Square, (for GF Square, and FQ Square, would then be the ſame Thing); that is, the Rectangle DFE would be = to CF Square, which is utterly impoſſible, as is plain from 6. *E.* 2. *Euclid.*

Wherefore theſe Lines are true *Aſymptotes*, as *Apollonius* named them from this Impoſſibility of Co-incidence with the Curve of the *Hyperbola*, when placed in this Poſition. *Vid. Apoll. Prop.* 1. *Lib.* 2.

HYPERBOLA. In *Philoſ. Tranſact*, N. 34. you have a Quadrature of the *Hyperbola* by the Lord Viſcount *Brouncker*, by a Series founded on what Dr. *Wallis* hath demonſtrated in his *Arith. of Infinites*, *Prop.* 87, 88, 89, &c. And in *Philoſ. Tranſ. N.* 306. by a *New Quadratrix*, invented by the Ingenious Mr. *J. Perks* of *Great Swinford* in *Worceſterſhire*; together with the Conſtruction and Properties of that Quadratrix.

HYPERBOLE, [ὑπερβολὴ of ὑπερβάλλω, Gr. to ſurpaſs,] in *Rhetorick*, is a Figure which repreſents Things greater, leſſer, better, &c. than in Reality they are; and is uſed in Diſcourſe, when our ordinary Terms are too weak or too ſtrong, and carry no Proportion with our Idea; and leſt we ſhould ſpeak too little, we fly out, and ſay too much, or the contrary: As to expreſs the Swiftneſs of a Horſe, one ſhould ſay, He was *ſwifter than the Wind*; if the Slowneſs of a Perſon, That *he moves ſlower than a Snail.*

HYPERBOLICK } [ὑπερβολικὸς, Gr.] of
HYPERBOLICAL } or pertaining to an Hyperbola, or Hyperbole.

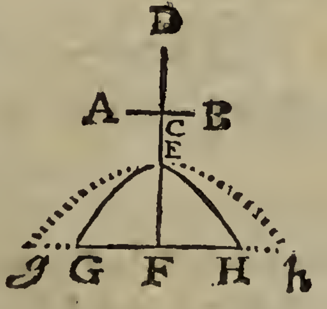
HYPERBOLICAL *Cylindroid*, is a ſolid Figure, whoſe Generation is given by Sir *Chriſtopher Wren*, in *Philoſoph. Tranſact. N.* 48. There are two oppoſite *Hyperbolæ*, join'd by the *Axis Tranſverſus*; and through the Centre there is a Right Line drawn at Right-Angles to that *Axis Tranſverſus*; and about that, as an Axis, the *Hyperbolæ* are ſuppoſed to revolve: By which Revolution a Body will be generated, which he calls an *Hyperbolick Cylindroid*; and whoſe Baſes, and all Sections parallel to them will be Circles. And in *N.* 53. of the *Tranſactions*, he applies it to the Grinding of *Hyperbolical Glaſſes*, and ſaith, They muſt be either form'd this way, or not at all.

HYPERBOLICK *Leg*, a Name that ſome Authors give to the Hyperbole itſelf.

HYPERBOLICK *Leg* [of a *Curve*] is that which approaches infinitely near to ſome Aſymptote.

HYPERBOLICK *Space*, is the Area or Space contained between the Curve of an *Hyperbola* and the whole *Ordinate.*

Any *Hyperbolick Space* $GEHG$: is to any other Hyperbolick Figure of the ſame Height $gEhg$, (whoſe *Latus Rectum* and *Tranſverſum*, as in the Circle, are equal, and alſo both equal to DE, the *Latus Tranſverſum* of the former Space) :: As the Conjugate Axe AB : is to the *Latus Tranſverſum* DE.



For the Square of gF (the Ordinate) is = to the Rectangle DFE, (by the Hyperbola): Wherefore the Rectangle DFE (= Square FG) :

FG) : is to the Square FG :: as *Latus Tranſverſum* : is to *Latus Rectum* of the Hyperbola $GEHG$; *i. e.* as the Square DE : Square AB. Wherefore the Roots of theſe Squares will be alſo proportional, and conſequently $Fg : FG :: DE : AB$; the former two Terms of which being each an Indiviſible of the two *Hyperbolick Spaces*, it will follow, that the whole Spaces are in the ſame Proportion.

Wherefore $gehg : GEHG :: DE : AB$.
Or $GEHG : gehg :: AB : DE$.
Q. E. D.

Hence, if you find the Quadrature of any Hyperbola, whoſe Parameter and *Latus Tranſverſum* are equal, you may ſquare any other Hyperbola.

In *Philoſoph. Tranſact. Numb.* 34. there is a Quadrature of the Hyperbola by an infinite Series of Rational Numbers.

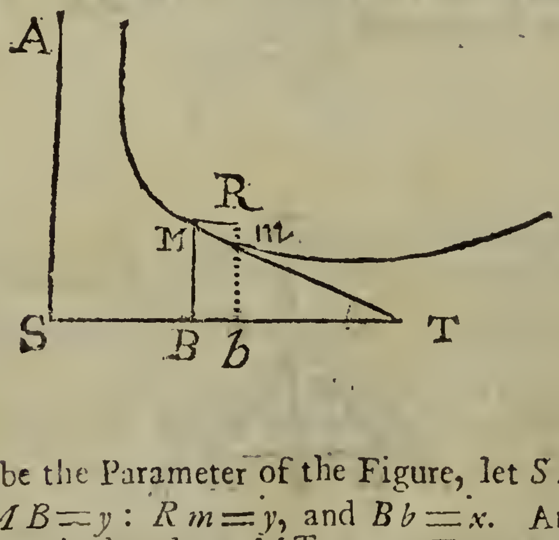
In *Numb.* 53. there is a Method communicated by Sir *Chriſtopher Wren*, for grinding Glaſſes of an Hyperbolick Figure.

HYPERBOLICUM *Acutum*, is a Solid made by the Revolution of the infinite Area of the Space contained between the Curve and the Aſymptote, in the *Apollonian Hyperbola*, turning round that Aſymptote ; this produces a *Solid*, or *Body* infinitely long, and yet as *Torricellius* plainly demonſtrates, (who gave it this Name) it is equal to a finite Solid, or Body.

HYPERBOLI-FORM *Figures*, are ſuch Curves as approach in their Properties to the Nature of the Hyperbola ; and are called alſo *Hyperboloides*.

The Method of drawing Tangents to Hyperboli-form Figures.

Let AS, ST, repreſent the Aſſymptotes of the Equilateral Hyperbola Mm ; then will S be the Centre of the oppoſite Sections. Draw the Ordinate MB, and another infinitely near, as mb.



Let p be the Parameter of the Figure, let $SB = x$, and $MB = y$: $Rm = \dot{y}$, and $Bb = \dot{x}$. And let it be required to draw MT, a true Tangent to the Curve in the Point M, ſuppoſe all done, as in the Figure : Then will the Triangles MBT, and MRm be ſimilar ; and therefore $\dot{y} : \dot{x} :: y : \frac{\dot{x}y}{\dot{y}}$ ($= BT$.) Now the proper Equation for the Curve is $\boxed{pp = xy}$; wherefore their Fluxions will be equal, *viz.* $o = \dot{x}y + y\dot{x}$; or $\dot{x}y = -\dot{y}x$: And dividing by x, it will be $\frac{\dot{x}y}{x} = -\dot{y}$. But from the Ordinate's continual decreaſe as the Abſciſſa increaſes, the $\frac{\dot{x}y}{\dot{y}}$ ($= BT$,) muſt be $\frac{\dot{x}y}{-\dot{y}}$, you have $BT = -x = SB$.

C O R O L. I.

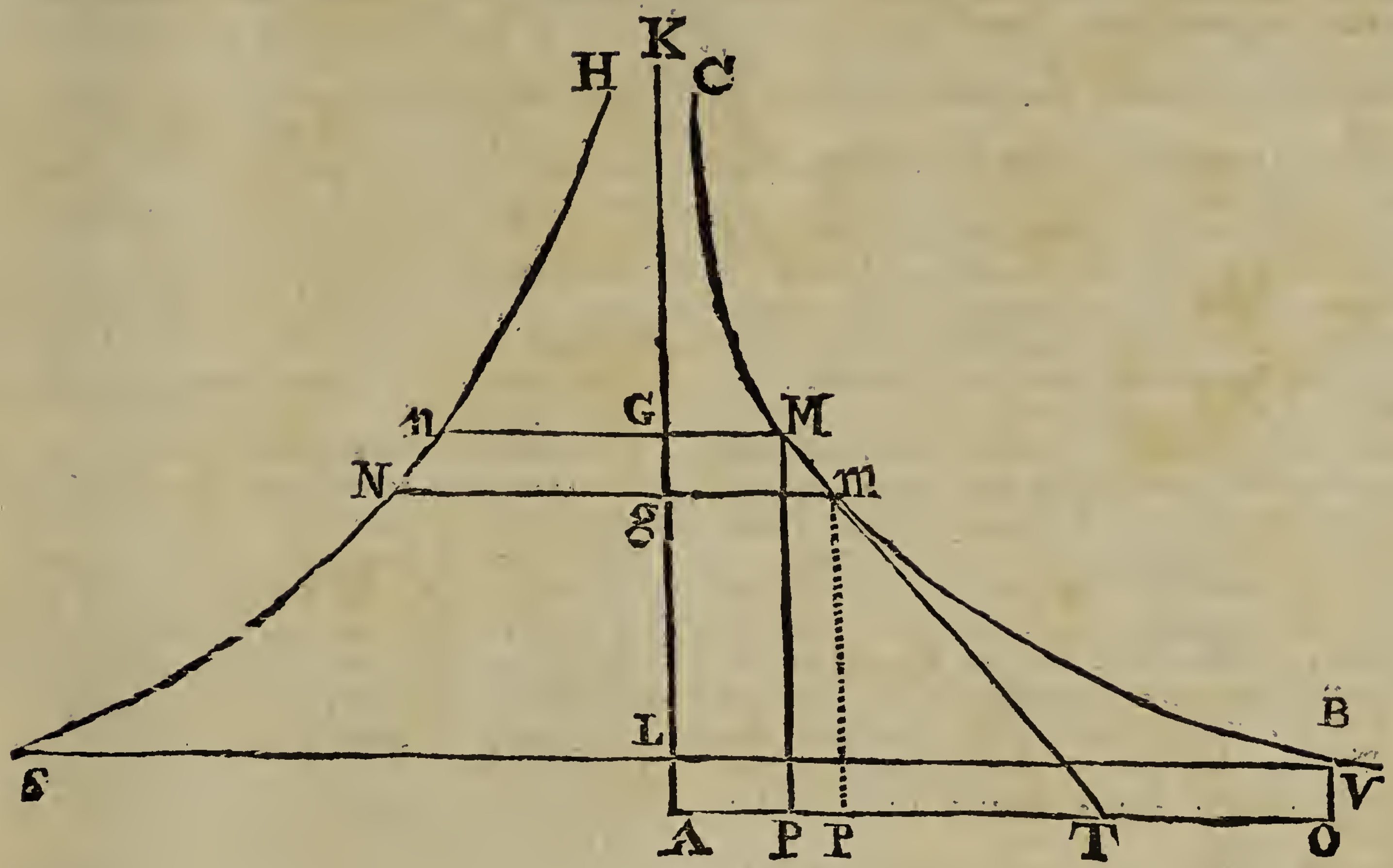
When the Value of the Sub-tangent BT comes out negative, then the Point T will fall, as here, on the contrary Side of the Ordinate, with regard to S, the beginning of x. But when it comes out poſitive, the Point T will be on the contrary Side ; as in the *Parabola*.

C O R O L. II.

If you ſuppoſe the Parameter $= 1$, and m to be a Negative Number ; then $y^m = x$ is an Expreſſion for all *Hyperboli-form Figures* ; and univerſally the Length of the Sub-tangent BT, $\left(= \frac{\dot{x}y}{\dot{y}}\right) =$ (becauſe $y^m = x$ and conſequently $my^{m-1}\dot{y} = \dot{x}$) I ſay, $=$ to $my^m =$ (becauſe $y^m = x$) to mx ; that is, *To the Exponent, of the Power of the Ordinate multiplied into the Abſciſſa.*

To inveſtigate the Area's of all ſorts of Hyperboli-form Figures.

In the following Figure, let the Curve $CMmB$ be an Hyperboloid ; AK and AO the Aſymptotes : Let the Sub-tangent PT be called t, and the Ordinate $PM = y$. The General Equation for ſuch Curves being $y^m = x$; and the Expreſſion for the Sub-tangent PT being mx, as above. Let Gn, in the Figure, be always taken equal to PT: Then will $t\dot{y} = y\dot{x}$. And the Rectangles $NIGn = t\dot{y}$, will always be equal to the Rectangle $PRmp = y\dot{x}$: And if this be always done, the Figure $KAOBC$ infinite towards KC, will be equal to Figure $KLSH$, equal to all the $t\dot{y} =$ (becauſe $t = mx$) all the $mx\dot{y}$. But (ſuppoſing the Figure $KAOBC - b$; and the inſcribed Rectangle $LBOA = d$) then will the Figure $KLBC = b - d =$ all the $\dot{x}y$ (becauſe $IR = \dot{x}$, and $RM = \dot{y}$.) Whence all the Rectangles $mx\dot{y} =$ all the $y\dot{x} = b$, are to all the $\dot{x}y = b - d$, as m is to 1. And by Diviſion,



$m : m - 1 :: b : n$; that is, the Figure *KAOBC*: Is to the inſcribed Rectangle :: As the Exponent of the Power of the Ordinate m : Is to the ſame Exponent leſs 1.

COROLLARY.

If m be greater than 1; then the Space, indeterminate towards *K*, may be meaſured : But if $m = 1$, then the ſecond Term in the Analogy $m - 1 = 0$; and conſequently, the Space *KAOBC* is infinite towards *K*; and infinitely great in reſpect of the Rectangle *LO*. But if m be leſs than 1, that Space *KAOBC* will be more than infinite.

Thus in the common *Apollonian Hyperbola*, whoſe Equation is $y^{-1} = x$; or (ſuppoſing a the Parameter $= 1$) $aa = xy$; it appears that $m - 1 = 0$; and conſequently, it appears that the Proportion between the Rectangle *LO*, and the ſaid infinite Space is infinitely great. *See more of this in* Hayes's *Fluxions*, *p.* 61, *&c.*

HYPERBOLOIDES [of ὑπερβολὴ and εἶδος, Gr. Form] are Hyperbola's of the higher kind, wherein $m > 1$ and $n > 1$ *e.g.* $ay 3 = bx 2 (a+x)$.

HYPERBOREAN [in *Geography*, ſituated to the Northward of *Scythia*, of ὑπερ beyond, and Βορέας, Gr. the North Wind.] Hence the Inhabitants of thoſe Places were called *Hyperboreans*.

HYPERCATALEPTICK *Verſe*: See *Depoſition.*

HYPERCATHARSIS, [of ὑπερ over and above, and καθαρέω, Gr. to purge,] is a Purge that works too much.

HYPERCRISIS, [ὑπέρκρασις, Gr.] is a Critical Excretion above meaſure.

HYPERCRITICK, [of ὑπὲρ above, and κριτικὸς of κριτὴς a Judge, of κρίνω, Gr. to judge,] an over rigid Critick or Cenſor, who lets nothing paſs, but animadverts ſeverely on the ſlighteſt Fault.

HYPERDISYLLABLE, is a Word of more Syllables than two.

HYPERDULIA, [Ὑπερδουλία of ὑπὲρ, over and above, and δουλεία, Gr. Worſhip, Service, *&c.*] a Name in the *Romiſh* Theology, for that Worſhip that they render to the Virgin Mary; that Worſhip they render to other Saints they call δουλεία, *Dulia*, and that to her *Hyperdulia*, as being ſuperior to the other, as being the Mother of God.

HYPEREPHIDROSIS, [of ὑπερ and ἐφίδρωσις, Gr.] is too much Sweating.

HYPERMETER, [ὑπέρμετρον of ὑπὲρ and μέτρον, Gr. Meaſure,] the ſame as *Hypercatalectick*.

HYPEROA, [ὑπερῶα, Gr.] are the two Holes in the upper Part of the *Oſſa Palati*, which receive the pituitous Humours from the Mammillary Proceſſes, and after they are ſeparated, diſcharge them at the Mouth. Thro' thoſe a Branch of the Fifth Pair of Nerves paſſes to the Palate, Uvula, and Gums.

HYPERSARCOSIS [of ὑπερ and σαρκῶσις, of σὰρξ, Gr. Fleſh,] is an Excreſcence of Fleſh in any part.

HYPERTHYRON, [ὑπέρθυρον, Gr] in *Architecture*, is a large Table, uſually placed over Gates or Doors of the Dorick Order, above the Chambranle, in form of a Frize.

HYPETHRE, in the Antient Architecture, was two Ranks of Pillars all about, and ten at each Face, of any Temple, *&c.* with a Periſtyle within of ſix Columns.

HYPHEN, [ὕφεν, Gr.] is an Accent in Grammar, that implies two Words are to be join'd, as *Male-Sanus*.

HYPNOTICKS, [ὑπνοτικὰ of ὕπνος, Gr. Sleep,] are thoſe Things, which by either fixing the Spirits, or by ſtraitning and ſhutting up the Pores, cauſe Sleep. *Blanchard.*

HYPOBIBASMUS: See *Equation*, *N.* 4.

HYPOBOLE [ὑποϐολὴ, Gr. Exceſs,] is a Figure in *Rhetorick*, whereby we anſwer what we prevented to be objected againſt by an Adverſary.

HYPOCATHARSIS, a too weak or feeble Purgation.

HYPOCHONDRIACA *Affectio*: See *Hypochondriacus Affectus.*

HYPOCHONDRIACUS *Affectus*, is (ſaith *Blanchard*) a kind of Convulſive Paſſion or Affection, ariſing from the flatulent and pungent Humours in the Spleen or Sweet-bread, which afflicts the Nervous and Membranous Parts. *L.*

Or, as others ſay, it proceeds from windy Humours bred in the *Hypochondres*, whence a black Phlegm ariſeth that infects the Animal Spirits, and they the Mind, and is what they call *Hypochondriack Melancholy.*

HYPOCHONDRIUM, [of ὑποχονδρεὶα of ὑπὸ under, and χόνδρος, Gr. a Griſtle,] or *Subcartilagineum*, is the upper part or Region of the *Abdomen*, under the Cartilages of the Cheſt or ſhort Ribs: In the Right *Hypochondrium* lies the Liver, and a part of the Stomach; in the Left the Spleen, and a greater part of the Stomach.

HYPOCHYMA, [Ὑπόχυμα of ὑποχέω, Gr. to pour under,] is a depraved Sight, whereby Gnats, Cobwebs, little Clouds, or ſuch like, ſeem to ſwim before the Eyes. The Cauſe of it ſeems to conſiſt in turbid Humours, or ſometimes in the Optick Nerves, whoſe little Pores are obſtructed by the Matter that is thruſt into them. *Blanchard.*

HYPOCHYSIS, the ſame with *Hypochyma.*

HYPOCRAS, [ſome derive the Name from *Hippocrates*, and others of ὑπὲρ over and above, and κεράννυμι, Gr. to mix,] a kind of Beverage made of Wine, with Spices and other Ingredients infuſed in it.

HYPOGÆUM, [Ὑπογαῖον, Gr.] a Name which the antient Architects gave to all the parts of a Building that were under Ground; as Cellars, &c.

HYPOGASTRICK *Artery*, is by ſome ſaid to be a Branch of the internal *Iliaca*, and diſtributes it ſelf among the Parts of the *Hypogaſtrium*, to the Bladder, *Rectum* (in Females to the outer and inner ſide of the *Matrix* and *Vagina*) *Veſiculæ Seminales*, *Proſtatæ Penis*, and to the *Os Sacrum*, and all Parts continued in the *Pelvis*: Then it gives two conſiderable Branches, which go out of the lower Belly; the firſt paſſes under the *Pyriformis*, and goes to the *Glutæi*; the ſecond goes to the *Obturatores* and the *Glutæus Major.*

HYPOGASTRIUM, [Ὑπογάστριον of ὑπὸ and γαστὴρ, Gr. the Belly,] is the lowermoſt Region of the *Abdomen*, reaching from three Inches below the Navel, to the *Abdomen*, *Os Pubis*, and Groins.

HYPOGLOSSIS, [Ὑπογλωσσις, Gr.] or *Ranula*, is an Inflammation or Exulceration under the Tongue: Alſo a Medicine that takes away the Aſperity of the Larynx. *Blanchard.*

HYPOGLOTTIS, [Ὑπογλωττὶς of ὑπὸ under, and γλῶττα, Gr. the Tongue,] the two Glands of the Tongue are ſo call'd: The Tongue has four large Glands, two of which are ſituate under it, near the *Venæ Ranulares*, and are called *Hypoglottides*; the two other are on the Sides of the Tongue: They all filtrate a kind of ſerous Matter of the Nature of *Saliva*, which they diſcharge by ſmall Ducts near the Gums into the Mouth.

HYPOMOCHLION, [Ὑπομοχλιον, Gr.] or *Prop*, in *Mechanicks*, ſignifies the Roller, which is uſually ſet under the Leaver, or under Stones or Pieces of Timber, to the end that they may be more eaſily lifted up or removed.

HYPOPHTHALMIA, [Ὑποφθαλμια, Gr.] is a Pain in the Eye under the Horney Tunick. *Blanchard.*

HYPOPHORÆ, are deep, gaping, and fiſtulous Ulcers. *Blanchard.*

HYPOPHYLLOSPERMOUS *Plants*, are ſuch as bear their Seeds on the Backſides of their Leaves, as the *Capillaries*: See that Word.

HYPOPYON, [Ὑπόπυον, Gr.] is a gathering of Matter under the Horney Tunick of the Eye, which ſometimes covers the whole *Pupil*, hindering the Sight, and ſometimes incompaſſes the Circle of the *Iris*, like the paring of a Nail; whence 'tis called *Onyx* or *Unguis.*

HYPOSARCA, the ſame with *Anaſarca.*

HYPOSARCIDIUM, the ſame as *Anaſarca.*

HYPOSILOIDES: See *Hyoides.*

HYPOSPATHYSMUS, [ὑποσπαθισμος, Gr.] is an Inciſion in the Forehead, made by three Cuts or Diviſions, and where the Spatula is thruſt in under the Skin. *Blanchard.*

HYPOSPHAGMA, [ὑπόσφαγμα, Gr.] is a Blood-ſhot from a ſtroke upon the Eye.

HYPOSTASIS *Urinæ*, is that thick Subſtance which generally ſubſides at the Bottom of the Urine.

HYPOSTASIS, [ὑπόστασις of ὑπὸ under, and στάσις of στάω or ἵστημι, Gr. to ſtand and exiſt,] Subſiſtance, a Term us'd in Theology for Perſon.

HYPOSTASTICAL *Principles*; *Paracelſus* and his Followers, called the three Chymical ones, *Salt*, *Sulphur*, and *Mercury*, ſo.

HYPOTHENAR, [ὑπόθεναρ, Gr.] is a Muſcle which helps to draw the Little-finger from the reſt; alſo the Space from the Fore to the Little-finger. *Blanchard.*

HYPOTHENUSE, [ὑποθείνουσα, Gr.] in a Right-angled Triangle, is that Side which ſubtends the Right-angle, and conſequently the longeſt. The Square of this Line in a Right-angled and Right-lined Triangle, is always equal to the Sum of the Squares of the other two Sides, *Prop.* 47. *E.* 1. *Euclid.* See the Demonſtration under *Triangle.*

HYPOTHESIS, [ὑπόθησις of ὑπὸ under, and θέσμα poſition, of τίθημι I put, Gr.] a Propoſition or Principle which we ſuppoſe, or take for granted, in order to draw Concluſions from it, in order to the proof of a Point in queſtion.

HYPOTHESIS, the ſame with *Suppoſition*: When for the Solution of any *Phænomena* in Natural Philoſophy, Aſtronomy, &c. ſome Principles are ſuppoſed as granted, that from thence an intelligible and plauſible Account of the Cauſes, the Effects of the propoſed *Phænomena* may be given, the laying down or ſuppoſing ſuch Principles to be granted, is called an *Hypotheſis*; and the Thing ſaid to be accountable eaſily according to that *Hypotheſis*, if it give a clear and eaſy Solution of the *Phænomena*. Wherefore an *Hypotheſis is a Suppoſition of that which is not, for that which may be*; and it matters not whether

ther what is ſuppoſed be true or not, but it muſt be poſſible, and ſhould always be probable.

An *Hypotheſis*, in ſome Senſe, falls in with a Syſtem: But this Word is uſually taken in reſpect to the Univerſe, and in Relation to the Diſpoſitions of the Heavens, and the Motion of the Stars: An elaborately contrived *Hypotheſis* about which, is called a *Syſtem*; as the *Ptolemaick*, *Copernican*, or *Tychonian Syſtem*.

HYPOTHESIS, [in *Phyſicks*, &c.] a ſort of Syſtem laid down from ones own Imagination, by which to account for ſome *Phænomenon* or Appearance in Nature.

HYPOTHESIS, [in *Aſtronomy*,] a Term us'd of the ſeveral Syſtems of the Heavens; or the different manners whereby different Aſtronomers have ſuppos'd the heavenly Bodies to be ranged, moved, *&c.*

HYPOTHETICAL, [ὑποθετικὸς, Gr.] pertaining to Suppoſition.

HYPOTHETICAL *Propoſitions*, [in *Logick*,] is a Combination of two categorical Propoſitions, the latter of which follows from the former, which is diſtinguiſhed by the Particle *if.*

HYPOTRACHELION [of ὑπὸ under, and τράχελος, Gr. the Neck,] the lower part of the Neck.

HYPOTRACHELION, [ὑποτραχήλιον, Gr.] in *Architecture*, is the Top or Neck of a Pillar, or the moſt ſlender part of it which toucheth the Capital.

It is taken by ſome for that Part of the *Tuſcan* and *Dorick* Capitals which lies between the *Echinus* and the *Aſtragal*; and is otherwiſe called the *Collar*, *Gorge*, or *Frize of the Chapiter.*

HYPOTYPOSIS, [ὑποτύπωσις, Gr.] is a lively and exact Deſcription of any Object made in Fancy.

HYPOZOMA, is a Membrane that parts two Cavities, as the *Mediaſtinum* in the *Thorax*. *Blanchard.*

HYPSILOGLOSSUS: See *Baſiogloſſus.*

HYSSOPICK *Art*, a Name given to *Chymiſtry* by *Paracelſus*, in alluſion to that Text in the *Pſalms*, *Purge me with Hyſſop*, becauſe Chymiſtry purifies Metals, Minerals, *&c.*

HYSTERALGY, [ὑστεραλγία of ὑστέρα the *Matrix*, and ἄλγος pain, Gr.] a pain in the *Matrix* or Womb, occaſioned by an Inflammation or other Diſorder therein.

HYSTERICA, [ὑστερικὰ, Gr.] are Medicines againſt the Diſeaſes of the Womb.

HYSTERICA-PASSIO, Fits of the Mother, is (according to ſome) a Convulſion of the Nerves of the *Par Vagum* and Intercoſtal in the *Abdomen*, proceeding from a pricking Irritation or Exploſion of the Spirits: This Diſtemper does not always, nor indeed uſually, depend upon the Womb, as is commonly thought: 'Tis ſeen ſometimes in Men, becauſe the Spleen, Pancreas, and other adjacent Bowels, are often the Cauſe of it. *Blanchard.*

Dr. *Purcell*, in his Book of Vapours, attempts to prove, and with Probability, That the Cauſe of Hyſterick Fits is neither the *Six Non-natural Things*, nor the ſolid Parts of the Body, nor the Blood, nor any of the Recrements, nor the Womb, not Vapours thence ariſing, nor the irregular diſorderly Motion of the animal Spirits; nor is it in the Chyle, or in the Ferment of the Stomach or Guts, *&c.* But he ſuppoſes the true Cauſe to be Crudities and Indigeſtions in the Aliments, which, by little and little, gather together in the Wrinkles and Folds of the Stomach and Guts; where they (as he ſuppoſes) lie for ſome time without much ſenſible Motion or Fermentation within themſelves, till at laſt by the Heat of the circumjacent Parts, their groſſer Salts are divided and put into Motion; which Fermentation is augmented by the various Juices which flow into the Guts from the many Glands which are placed in the Lower Belly; and by this means they are ſo diſſolved and liquified, as to enter in by the *Venæ Lacteæ* into the Blood, where they produce thoſe Accidents which cauſe the Symptoms of this various Diſeaſe.

HYSTEROLOGY, [ὑστερολογία of ὕστερον and πρώτερον, and λέγω, Gr. to ſay,] a Rhetorical Figure, being an inverted Diſcourſe, a vitious manner of ſpeaking, wherein the natural Order of Things is inverted.

HYSTEROMOTOCIA [of ὑστέρα the Womb, τομὴ a cutting, and τόκος, Gr. a Birth,] or *Sectio Cæſarea*, is a cutting the Child out of the Womb; which is done thus: You make a *Semi-lunar Section* under the Navel along the *Linea Alba*, the Cavity whereof looks towards the ſaid Line; then according to the leading of the Fibres, the *Fœtus* being extracted after the Section, the Wound in the Womb contracts of it ſelf, ſo that the Blood ſcarce flows more plentifully than in a Natural Birth; but if the Mother be dead, chooſe the moſt convenient Place you can. *Blanchard.*

HYSTERON PROTERON, [ὕστερον πρώτερον, Gr.] a Term us'd when Perſons ſpeak in an inverted Order of Words, or, as we ſay, *ſet the Cart before the Horſe.*

HYSTEROTOMIA, [υστερωτομια of ὕστερα and τεμνω, Gr. to cut,] is an anatomical Diſſection of the Womb.

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